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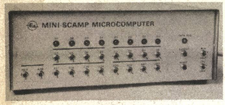

Our exciting Mini-Scamp microcomputer project has already grown. On page 78 we give details for expanding its memory to either 1,024 bytes of RAM or 1,280 bytes of mixed RAM and ROM, and tell you how to interface it to a teleprinter or a video terminal.

Great projects for you to build:

- **New hifi speaker system featuring 3 drivers mounted in a compact 53 litre enclosure/30**
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On the cover

Personnel access control systems are now a feature of many buildings, particularly where sensitive data must be protected. Our cover shows an identity card being inserted into a card-key reader which controls a door latch, and thus allows entry only to authorised personnel. On page 8, we take a look at some of the new access control systems currently under development for safeguarding computer data. Photograph courtesy Wormald International Ltd.

What's a big company like Philips doing in a place like Hendon?

We are producing standard and custom designed Integrated Circuits: IC's that are Australian-designed, Australian-diffused, and Australian-made.

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So we have done something positive to back up that belief. We've trained and employed a highly skilled team of engineers, technicians, and process workers in our semiconductor plant in Hendon, South Australia. We've put millions of dollars into the plant and equipment, and we'll invest more to satisfy the demands of the future.

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Editorial Viewpoint

The need for a national energy policy

Since I wrote last month's leader on solar energy, there have been quite a number of public statements and discussions on this topic and the related matter of overall energy policy formulation. It is good to see the growing interest in these areas, which have surely been ignored for too long.

Among the more significant statements reported in the daily press was that made by the Foundation for Australian Resources, when it presented the Minister for National Resources with the report of a major computer-aided simulation study looking into the future economic implications of various solar energy policy options. The results of the study suggest very strongly that Australia should greatly increase its spending on solar energy development, both as a long-term investment and to protect our economy against future fuel crises.

Thanks to the kind co-operation of the Foundation's chief executive officer Dr. Barry Thornton, I was able to see a copy of the report, and found it very interesting and thought-provoking reading. It is shortly to appear as a book titled Solar Australia—Australia at the Crossroads, which I would recommend to anyone interested in solar energy and Australia's future.

Perhaps the other main event of relevance to solar energy has been the release of the Senate Standing Committee on National Resources' report on its inquiry into solar energy.

In its report the Committee points out that at present Australia has no national energy policy, and suggests that the establishment of such a policy should be an important priority. It goes on to recommend that the Government sets up a statutory body, the Australian Energy Commission, to develop and co-ordinate long term energy policy.

This seems to me to be an excellent proposition. Solar energy cannot be viewed in isolation, but as part of an overall energy and resources policy. And unless we have a body specifically charged with long-term policy formulation, it seems unlikely that we will ever be able to see beyond short-term expediency and make the quite significant changes in our energy consumption, usage, reticulation and generation which will be required to take full advantage of solar energy.

What worries me a little about the Committee's report is that it seems to reflect at least partly an attitude of "there's tons of time, let's just set up an Energy Commission, and she'll be right." As the Committee itself points out, it is likely to take some time before solar energy could make any significant contribution to Australia's energy needs. In view of the steadily increasing problems and costs associated with other sources of energy, this seems to me to suggest that we can't afford to be complacent.

The message seems clear: the sooner we set up a national Energy Commission and formulate a long term energy resources policy, the better.

—Jamieson Rowe

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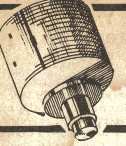


News Highlights

The future is big for auto electronics

US shipments of automotive electronic systems for the original equipment market are projected to grow over 20 percent annually from $1 billion in 1975 to $15.5 billion in 1990. The major reason for this growth is that electronic systems are the only methods available to achieve government pollution abatement and safety standards. Other factors causing this dramatic growth include increased automobile production, rising affluence, higher fuel costs, product upgrading, new product development and higher material and labour costs.

These are the key findings presented in an extensive new market study on Automotive Electronic Systems. The study was prepared by the Research Group of Predicasts Inc., a Cleveland based business/information market consulting firm and a close follower of new electronics applications in passenger cars for the last five years. According to Predicasts, the value of electronic systems will amount to $1250 per car by 1990, compared to $150 per car in 1975.

In the 1960's radios and other entertainment equipment were the only electronic systems in automobiles. However, increased pollution regulations coupled with greater need for improved gas mileage is creating the need for electronic engine controls.

Electronic ignition systems with spark timing control are receiving the greatest amount of research and development efforts and will be the major area for electronics applications in the late 1970's. Consequently, shipments of electronic ignition and timing systems and sensors will reach $1.4 billion by 1980 and $2.2 billion by 1990. Microprocessors will be used in most systems to handle the various sensor inputs and shipments of components for ignition systems will reach $435 million by 1990.

Electronic fuel metering will follow electronic ignition as standard equipment for the engine control function. Inexpensive digital sensors that permit monitoring of combustion and exhaust parameters will be available in the early 1980's. Microprocessors will also be used in the control function. Speed control devices will increase in popularity but radar control systems will not be economically feasible until after 1980.

Rising consumer affluence and new products will raise the market for eletronic comfort systems from $295 million to $2.7 billion in 1990, according to Predicasts. Major gains are expected for CB radios, temperature control, electronic clocks, and miscellaneous devices such as automatic seat positioners and headlight control.

Trainer simulates nuclear emergency

Trainees prepare to take action in an "emergency" at a nuclear power station. Though it seems real enough to them, there is no real breakdown—the "fault" was produced by their instructor (left) from his control panel on this detailed simulator of Britain's Prototype Fast Reactor.

With the increasing complexity of industrial plants, the consequences of operational mistakes have become more serious. The PFR simulator allows operators to practise both routine and emergency procedures that would be impractical using 'live' plant.

The equipment can also be used for scientific study of the plant and control system, and to aid the development and testing of operating performance.

NS extends uP training courses

Additional courses on the applications of SC/MP, PACE and Super PACE, and IMP microprocessors will be given by NS Electronics at their Sydney and Melbourne training centres, according to Jack Rutherford, Managing Director of NS Electronics, Bayswater, Victoria.

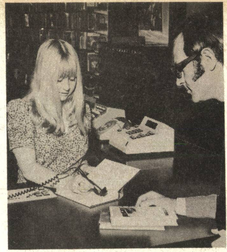
The added courses are scheduled for Sydney 15-19 August and 7-11 November; and for Melbourne 30 May-3 June, 12-16 September, 17-21 October, and 5-9 December.

The five-day courses discuss the fundamentals and tools of each of the microprocessors in detail to assist the student in solving future application problems. Complete lab stations are provided to allow students extensive machine experience.

In addition, the sessions feature hands-on time on 16-bit IMP and PACE microprocessor systems (floppy disc) for high speed software development and PROM programming.

Registration information may be obtained from National's training centre in Sydney (02) 93 0481 or Melbourne (03) 729 6333 or any NS Electronics office or franchised dealer.

Data capture pen for Melbourne library



A Melbourne suburban library will be the first in Australia to install the Plessey Light Pen book-control system now being used in more than 300 overseas libraries.

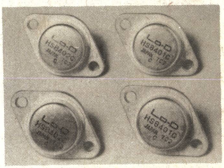
The library system, installation of which began in March, will handle all book dealings, circulation and statistics of the Oakleigh City Council library and its Clayton branch. These carry about 100,000 books for 25,000 borrowers.

A Plessey Light Pen–shaped like the common ballpoint–date-stamps and reads bar codes carrying data about each book and its borrower for recording on magnetic tape. The tape will be processed by the Local Authorities Superannuation Board's computer in St Kilda for a complete record of transactions and a catalog of subjects, titles and authors.

The Plessey library system also has facilities for trapping returned books wanted by other borrowers and identifying those who may have built up a bad record of defacement or annotations.

The Oakleigh chief librarian, Mr Jon Martindale, said that the new system promised faster, more accurate across-desk handling and access to all administrative data.

Power MOSFETs for audio amplifiers



Hitachi Ltd has developed the world's first complementary power MOSFETs for audio amplifier equipment, and will place them on the market from this year-end as types HS8401 and HS8402.

Both the HS8401 (N channel) and Model HS8402 (P channel) are intended for advanced audio amplifier designs. They are capable of producing an output power of 50W for single push-pull operation in Class B, and 100W for parallel push-pull operation.

Main advantages of the new power MOSFETs over bipolar transistors are said to be superior high frequency response and faster switching characteristics. In fact, Hitachi claim that the frequency response characteristics are more than 10 times superior to those of bipolar power transistors. The second advantage, faster switching, is claimed to greatly reduce total harmonic distortion and power dissipation at high frequencies.

Hitachi lists superior durability as another advantage of its new power MOSFETs over bipolar transistors. This will make it possible to simplify audio amplifier output stage protection.

AWA navigation aids to Afghanistan

An Australian company has beaten strong international competition to win a contract for the first stage of a modern air traffic control system for Afghanistan. Under the contract, Amalgamated Wireless Australasia Limited will supply and install aircraft navigational aid equipment valued at more than $½ million.

The contract covers the supply and installation of an Australian designed and manufactured radio beacon–Doppler VOR, Distance Measuring Equipment and a diesel power system at Kabul, the capital city, and Conventional VOR and a diesel power system at Delaram, a small town some 600kms from Kabul, situated under an important international airway.

The installations are the first of a network which will form a modern air traffic control system for Afghanistan. A further five installations will be provided under an approved national plan in the next few years. About 80 percent of the contract content is for Australian goods and services.

AWA Doppler VOR beacons are already operating at Kathmandu and Pokhara in Nepal, at Biggin Hill near London, UK; at Viseu in Portugal; at Mersing in Malaysia; and are being installed at 10 locations in Australia.

Watch yourself— CB antennas can be lethal!

A news item in the January 1977 issue of "Radio Electronics" warns of the potential dangers of CB antennas. According to the item, the US Consumer Product Safety Commission says it is studying the risk of electrocution from base-station antennas as a result of their coming into contact with high-voltage power lines. Apparently, some 30 people were killed in the US during the first four months of 1976 as the result of such mishaps.

One possible approach to the problem could be a requirement for manufacturers to print clear warning labels on packages containing communications antennas, or even notices attached directly to the antennas.

Still on the subject of CB, another item in the same issue forecasts a crackdown by the FCC on television interference (TVI) problems by forcing TV receiver manufacturers to include interference filtering in all new sets. It appears that the Commission is now taking a stronger stand that most of the fault for TVI lies in the TV, rather than in the CB transceiver.

Although the FCC currently has no power to force manufacturers to include interference protection in their TV sets, the rapid growth in CB could force the Commission to request authority. At the same time, the Commission seems set to tighten up harmonic suppression standards in CB transceivers. A figure of 100dB has been mentioned, although this probably won't come into force this year.

Production colour TV has built-in Teletext

Production versions of the first colour TV receiver with built-in Teletext facilities are beginning to reach London stores. The 22-inch sets, manufactured by Rank Radio International, are selling at a recommended retail price of £1,049.

The price of the set has surprised many observers, and does seem to conflict with recent predictions made by senior people in the electronics industry. Rank's comments are understandably guarded, with company spokesmen emphasising the present small production quantity and expensive production methods in force at this early stage. The company has also said something about being "component led", a reference to the difficult supply position for decoder chips.

Most of the early units are expected to find their way into business environments, hotels and some clubs—although inevitably there will be those private individuals whose pockects are deep enough.

Top Disc Cutting Studios, like The Mastering Lab, rely on Stanton's 681-Calibration Standard in their Operations.

Not everyone who *plays* records needs the Stanton Calibration Standard cartridge, but everyone who *makes* records does!

At The Mastering Lab, one of the world's leading independent disc mastering facilities, the Stanton 681 Triple-E is the measuring standard which determines whether a "cut" survives or perishes into oblivion.

A recording lathe operator needs the most accurate playback possible, and his constant comparing of lacquer discs to their original source enables him to objectively select the most faithful cartridge. No amount of laboratory testing can reveal true musical accuracy. This accuracy is why the Stanton 681 Series is the choice of leading studios.

When Mike Reese, principal disc cutter at The Mastering Lab, plays back test cuts, he is checking the calibration of the cutting channel, the cutter head, cutting stylus, and the lacquer disc. The most stringent test of all, the evaluation of direct to disc recordings, requires an absolutely reliable playback cartridge . . . the 681 Triple-E.

All Stanton Calibration Standard cartridges are guaranteed to meet specification within exacting limits. Their warranty, an individual calibration test result, comes packed with each unit. For the technological needs of the recording and broadcast industries, and for the fullest enjoyment of home entertainment, you can rely on the professional quality of Stanton products.

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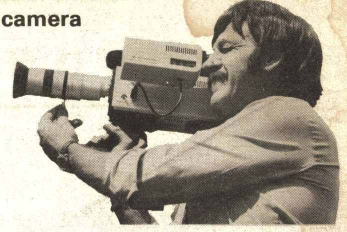
NEWS HIGHLIGHTS

World's smallest portable CTV camera for electronic news gathering



The world's smallest, fully self-contained portable colour TV camera is now available in Australia through AWA Rediffusion. It is the Hitachi FP-3030A, an easy to handle multi-purpose camera with low power consumption and incorporating a three-electrode colour pick-up tube.

The tri-electrode tube uses 3 electrodes in the one tube which does the job traditionally performed by three separate tubes. Weighing less than 3.5kg, the camera produces high quality colour pictures comparable to much more expensive 3-tube colour cameras, and is claimed to be superior to similar single tube, single electrode colour cameras.

Introduction of the new tube has made possible a substantial reduction in componentry compared with existing one tube colour cameras, according to AWA. This in turn offers simpler, more stable and more reliable operation. Even in varying temperatures the FP-3030A retains stable colour performance.

Due to its single unit construction, the FP-3030A can be used in the field powered from a battery in the camera itself, and is thus ideal for electronic news gathering, field production and for indoor/outdoor educational, medical, surveillance and home movie applications.

Telecommunications in the year 2000

Giant communications satellites will be assembled in space within the next 20 years, Sir Edward Fennessy, Deputy Chairman of the British Post Office and Managing Director Telecommunications, predicted recently. Powered by the Sun—or nuclear energy—they will have at least five times the capacity of modern satellites, he said. And if a fault occurred, a space shuttle would be sent off to repair them in orbit.

This fascinating glimpse of the technological revolution facing telecommunications was given by Sir Edward to world experts meeting at the Royal Society, London, to study changes in this field by the year 2000.

There would also be a complete change in undersea cables in that time. Optical fibre cables—where hair-thin strands of glass can each carry hundreds of phone calls on a beam of light—would be laid. And by the 1990s, Sir Edward said, each of these undersea cables could carry up to 25,000 conversations at once across the world's oceans—a sixfold increase on today's cables.

These new satellite and cable systems would pave the way for low-cost international "Confravision"—face-to-face conference by TV—which saves time and expensive air travel. If the costs were made low enough, this could possibly attract one tenth of the 12,000 people who fly the Atlantic each day, enabling them to conduct their business conferences by television 4,800km apart.

Outside the peak business hours, said Sir Edward, the same equipment could be used to send letters across the Atlantic by facsimile. This "electronic mail" service could handle well over half the letters sent between Europe and North America. Last year 104 million letters were flown from the UK to Canada and the USA.

Increased phone orders good news for industry

Increased orders could be just around the corner for major sections of the Australian telecommunications manufacturing industry as a result of a recently announced upsurge in applications for telephones, an upsurge which has proved to be a significant advance on the original demand forecast.

ATDA (Australian Telecommunications Development Association) opinion is that the upsurge is the best news the Australian industry has received for many months.

The managing director of Telecom Australia, Mr J.H. Curtis, recently announced that applications for telephones had increased by 15 percent in the six months to December 31, 1976, compared with the corresponding period of 1975.

The total number of applications in the six months to the end of December, 1976 was some 180,000. This increase in demand was 5 percent greater than the original demand forecast, said Mr Curtis.

Aust. company exports solar water heaters

Solahart, the solar energy division of the manufacturing company, S. W. Hart and Co. Pty Ltd, has just exported $250,000 worth of its solar hot water systems to the United States mainland.

The State Manager, Mr Barry Fisher, said that he expected the US market to become a very significant one for his company. Within the next 12 months exports should overtake the rapidly expanding Australian trade for the Solahart product.

Since beginning an export drive with a breakthrough to Hawaii twelve months ago, the company had received orders for more than $500,000 worth of its solar units. The total should exceed $2 million by the end of this year and top $8 million by the end of 1978.

"Americans are very conscious of the energy crisis and are encouraged to utilise solar energy," Mr Fisher said. "Initially we obtained market reactions by participating last November in the energy section of the Chicago Building and Construction Exposition. It became apparent that Southern California and Arizona were logical target areas because within a 400km radius of Los Angeles 25 million people live mainly in houses, and in climatic conditions at least equal to those enjoyed in Sydney."

Mr Fisher said that Solahart California had been established last December in Los Angeles and Sunrise Enterprises Inc., of Phoenix Arizona had been appointed sole distributors for the U.S. mainland. The units were receiving a very enthusiastic reception.

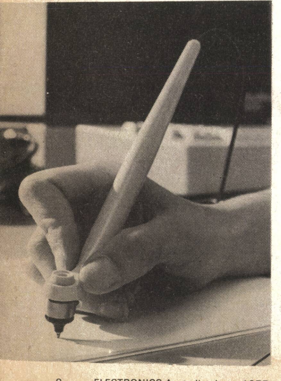
New ID systems are really hard to beat

The US Privacy Act of 1974 asserts that "the privacy of an individual is directly affected by the collection, maintenance, use, and dissemination of personal information by federal agencies." This law established stringent requirements for safeguarding such information within the US Government's data processing system. This article looks at some of the methods developed for safeguarding computer data.

by PAUL MEISSNER

In the United States computer systems store and transfer information on every taxpayer. This function is only the very tip of a large iceberg involving massive stores of data and transfer not only of information but also of money.

To uphold our privacy laws and ensure the security of both information and funds, we need sophisticated techniques for verifying the identity of individuals who are authorized to use a computer system. But no matter how sophisticated the techniques become, they divide into three categories: Identity can be verified on the basis of something a person knows, something a person has, or something unique about a person.



Signature verification: This instrumented stylus system is used in conjunction with a computer system to verify identity according to signature. A reference profile, consisting of pressures used in the signing, is compared with the dynamics of the signature presented.

Something a person knows could be a password, the combination to a lock, or a set of facts from his personal background (mother's maiden name, school teacher's name, places of residence, and so forth). Passwords are presently the most common form of information used to control access to computer terminals. Something a person has could be a key, an ID card, or a credit card. Something about a person could be a physiological attribute, such as fingerprints, handwriting, voice, or the length of his fingers. Various other features having distinctive patterns have been considered, such as the face, ears, teeth, and retina of the eye. Of course, people are most commonly recognised by their faces, but this form of identification is limited to situations in which a guard controls access to an area. There is also a serious question as to how well a guard can recognize an individual on the basis of a picture ID card if the individual is unknown to the guard.

Naturally, anything known to one individual could become known to another; thus if an unauthorized person learned the password to a computer system, he might gain access to the system to serve his own ends. Likewise, an object such as a key or credit card might fall into the wrong hands (or perhaps be counterfeited) and be used in an unauthorized manner. For these reasons, a great deal of emphasis is presently being placed upon the use of unique physiological attributes as a means of verifying identity.

Fortunately, the computer can be of great help in such verification. With the availability of small, inexpensive computers which are nevertheless capable of rapidly executing complex programs, it is possible to extract from a single but complex attribute a representative "reference profile." This reference profile may be compared through sophisticated matching and correlation routines with measurements of that physical characteristic obtained on future occasions. And a determination can be made as to whether these measurements are within an acceptable tolerance, thereby confirming or refuting the identity of the individual.

Typically, the reference profile is obtained by "training" a recognition system through an initial set of measurements, from which a set of averages and limits are obtained. With some systems, an adaptive process is included which enables the reference profile to follow a gradually changing attribute, such as might occur with ageing. A variety of systems for this type of identity verification are presently being developed in response to the growing importance and need for more reliable, inexpensive, and convenient methods.

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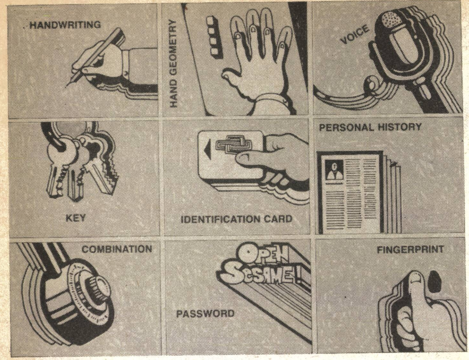
*Paul Meissner is a computer systems engineer in the National Bureau of Standards Institute for Computer Sciences and Technology (ICST). ICST is responsible to the US government for developing the necessary standards and guidelines for protecting computer data.



Part of the ICST computer security program involves the assessment of current techniques for verifying the identity of an individual.

Techniques for verifying the identity of authorised computer users can prevent would-be imposters from gaining access to systems.

How do these methods work?

In general, an individual must first present a claimed identity to the recognition system. He might, for example, type his name or enter an assigned identification number. This provides the system with the information for retrieving the proper reference profile and preparing to carry out the verification process. The person then goes through a specified "ritual, such as signing his name with an instrumented stylus, speaking into a microphone, placing his hand or finger on a scanning device, or whatever is required. Signals corresponding to the measured attribute are thus produced and are analyzed by the system and compared with the reference profile.

If a match is obtained within a specified tolerance, the identity is considered to be verified. An acceptance signal can then be produced to allow the person to proceed with some authorized activity. If a match is not obtained, a rejection signal is produced. The person may then be given another opportunity to identify himself on the chance that the first attempt failed due to marginal operation. Usually not more than three attempts would be allowed in order to prevent an imposter from trying repeatedly in the hope of being accepted on the basis of chance.

How do these recognition systems operate?

Recognition systems based on signatures make use of the dynamic features of the writing process (forces, velocities, accelerations) rather than the static signature image. These dynamic features are highly individualized and would be very difficult for a would-be impersonator to perceive or duplicate. It is interesting to note that the systems can be trained to perform recognitions on words other than the signature, although the signature is preferable since it is essentially a conditioned reflex action and is not under conscious control to the extent that an arbitrary word would be.

Of course, the person must be consistent in his choice of signature for this purpose. Many people have more than one signature, depending on whether they are signing formal documents, correspondence, or credit receipts. Any of these signatures could be used in training the system, but thereafter the person should use that same signature for verifying his identity.

When recognition is by voice, it is necessary for the person to speak into a microphone using words that have previously been entered into the system through a process in which the computer is conditioned to recognize the characteristic features of the person's voice. But a would-be impersonator might use a recording of the person's voice in an attempt at deception. To counter this threat, the system selects phrases at random, from a set of previously stored words. The selected phrases are delivered over a loudspeaker and the person must repeat them. The potential number of phrases is great enough that it would not be practical to use a recorder for reproducing the selected ones within the time available.

There are various ways of matching fingerprints automatically as a means of

This computer-driven ID system flashes a person's signature onto a TV screen at the touch of a few buttons. The system, installed in some US banks, is helping to provide better customer service and greater security in such transactions as withdrawals and personal cheque cashing.

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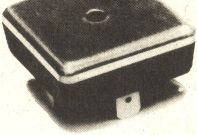

Like giving 10 extra amps current handling at the 25 amp price. Plus 100 extra amps surge-protection at the 25 amp price, and super-efficient, 70 watt power dissipation at the 25 amp price.

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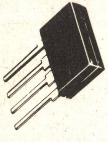

This super little bridge has outstanding performance and was designed to compete with a configuration of four 1N4001 series. Ideal for applications in TV's, stereos, hair dryers, shavers, radios, battery chargers, etc. The big advantages are its low cost, single ended package for ease of PC board mounting and high volume production capability.

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Computer ID Systems . . .

verifying identity. One method consists of performing an optical correlation between the live print and a file copy of the print. It is not necessary to resort to inked impressions for this process; a satisfactory image of the print can be obtained by placing the finger on a properly lighted prism. Another method is to scan the image and derive a digitized file of data representing the fingerprint "minutia." These are the distinguishing features such as the beginnings, endings, and branches that occur among the ridges which constitute the fingerprint. This file of minutia data can then be compared with a reference file by using software programs that match these minutia data.

Interestingly, the lengths of peoples' fingers have been found to vary enough to form the basis for a recognition system (hand geometry). This was discovered by the Air Force in measuring a large number of individuals to obtain data for making gloves. This phenomenon has been incorporated in a device which measures the distance from the tips of the fingers to the web between the fingers by using a motor-driven assembly of photocells. The measurement can be made in less than one second.

How well do these systems work?

There are two factors of particular interest in judging the performance of a personal recognition device: How well does it recognize the correct person, and how well does it discriminate against imposters. The rejection of correct persons is expressed by the False Alarm Rate (FAR), while the passing of imposters is expressed by the Imposter Pass Rate (IPR). In practical systems there is generally a trade-off between these two rates and there is usually an adjustment by which one can be favoured at the expense of the other. The amount of data is still quite limited, but FAR and IPR rates which are both in the range of 1 or 2 percent are being achieved and it may be possible to make one of the rates vanishingly small in some systems.

Computer security is made up of many elements, but the verification of individual identity is one of primary importance. Although the computer has opened up new possibilities for misappropriating resources and information, it has also, fortunately, provided us with a new class of techniques for verifying that a person is who he says he is. This capability can be used to establish safeguards so that we may continue to benefit from the many useful ways in which computers can serve us.

Reprinted from "Dimensions", Journal of the National Bureau of Standards, Washington DC.

Electronic door control system based on 6800 microprocessor IC

This Card Key Series 100 MAC (Microprocessor Access Control) System is used for monitoring a network of access control stations. Each station has a card-key reader and controls the striker plate on a door latch. When a valid card-key is presented at one of the stations the system will release the door located at that station, allowing access, and will log the time, the station number and the number of the card presented.

If an invalid card is presented an audible alarm is sounded at the central location and an alarm message is logged.

The system allows for up to 8 daisy chain circuits each with up to 4 stations for a maximum of 32 stations. Communication is bi-directional over two twisted pair wires. Stations are polled and respond with an 8 bit null reply or a repeated 32 bit message containing the card-number. A timeout will generate an alarm if no reply is received from the polled station.

The microprocessor maintains the clock from a one second interrupt, and monitors timeouts from the readers and the keyboard. It interprets keyboard entries, controls the LED displays, polls the remote stations and interprets their replies. It logs messages, sounds alarms and releases doors as required. Its primary function is to maintain the status of each of 1000 "Securiti-Cards", and to check the status of the cards presented at the station readers so as to determine whether to release the door or sound an alarm.

At the central location "Securiti-Cards" may be issued (made valid), tested or cancelled. To be issued, the actual card must be presented at a central reader. Cards may be cancelled by entering the card number on a keyboard. They may be tested either by entering the card number on a keyboard or by presenting the card to the card reader.

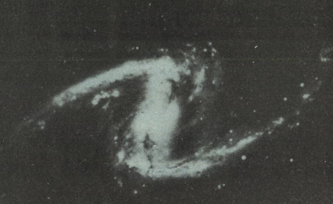
A 20 column matrix printer is used to print messages. Each message contains the date and time, the station number and card number and a message code. A special indicator is present only on error or alarm messages to make them stand out. The error messages show all parameters available and indicate the specific failure. For example, a card to be issued which is already valid is indicated separately fom one which has an invalid number.

A 4-digit LED display normally shows the time carried by the system. However, when a number is entered on the keyboard it is displayed on the 4 LEDs. The keying syntax requires a parameter to be entered before the command which requires it. The date, time, cancel and test commands then take their parameter from the LED display.

The microprocessor is a Motorola 6800. The program is stored in 1k of PROM and the valid/invalid card status indicators are held in a 1k by 1 bit CMOS RAM. An on-board rechargeable battery provides permanent power to the RAM so that the card status indicators are not lost by a power interruption.

Enquiries to Wormald International Ltd, Alexander and Ernest Streets, Crows Nest, NSW, 2065.

A visit to Siding Spring



Perched high on a mountain top near Coonabarabran, in NSW, the huge Anglo-Australian 3.9m optical telescope is making a vital contribution to our knowledge of outer space. An optical telescope, indeed, but almost everything else about it is electronically based, as our Editor-in-Chief discovered during a personal visit earlier in the year.

by NEVILLE WILLIAMS

Just prior to the visit, computer based data and equipment had directed the telescope to a critical point in space to capture the first-ever image of the Vela pulsar, and only the second photograph ever taken of one of these unique stars.

Radio astronomers associated with the University of Sydney had established the existence of the pulsar in 1968 but it was so faint in the optical sense that it had eluded optical telescopes until the beginning of this year. But the Siding Spring telescope finally captured the light image that pulses at the rate of eleven times per second and which, as now seen, actually left the pulsar 1600 years ago.

Australia has long had its complement of optical observatories but, since World War II, far and away the greatest local emphasis has been on space research using radio, rather than optical telescopes. This has been due, in no small degree, to the dedication of scientists, engineers and academics who were introduced to microwave technology by wartime radar—and to the concept that certain bodies in space radiated energy at "radio" as well as optical wavelengths.

One may even draw a parallel between Australia's prominence in radio astronomy and the successful development of the new Australian Interscan aircraft landing system.

But while radio astronomy is an invaluable tool in space research, its contribution to astrophysics—the study of radiation from astronomical bodies—is limited to the longer wavelengths in the radiation spectrum. In short, to what we currently accept as "radio" waves.

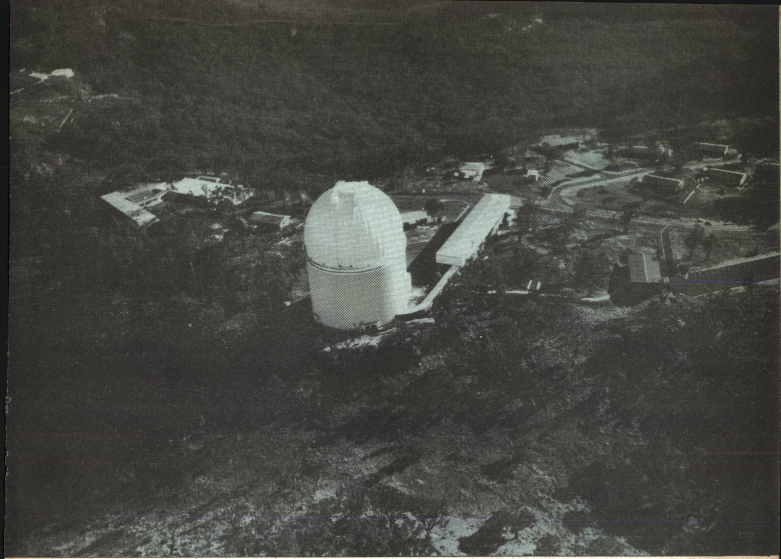
If scientists are to gain a more adequate insight into the nature of astronomical bodies—and to some of the related problems of time and space—they must also be able to build up parallel information about radiation at much shorter wavelengths: within, and adjacent to, the spectrum of visible light.

In no sense, therefore, have radio telescopes rendered redundant their optical counterparts. On the contrary, they have opened up vast new areas for research and set new performance criteria which optical telescopes have to match, if they are to make the contributions expected of them.

Indeed, these new criteria are currently being met by a combination of very precise technologies—optical, mechanical and electronic.

Nor should we overlook the human element: people whose perception has to keep pace with the technology they have created!

The term "astronomical body" is a curiously inadequate description of what optical astronomers are actually concerned with: single stars, clusters of stars, hydrogen gas clouds (nebulae), exploding stars (novae and supernovae), the



Above left: NGC 1365, a barred spiral galaxy, distance about 50 million years. The faint line crossing the print was made either by a satellite or a meteorite. Above is an aerial view of the AAT telescope.

remains of exploded stars (supernovae remnants), variable stars (varying in brightness), galaxies, quasars (very intense "radio" sources) and pulsars (stars that pulse in both radio and optical wavelengths).

As an example, photographic studies of the Vela Pulsar mentioned earlier, will inevitably modify—or validate—current theories about this unusual astronomical "body". Announcing their initial success, scientists at the Siding Spring Observatory said that a pulsar is currently thought to be formed by supernovae (exploding stars); the explosion disperses 90% of the star as gas clouds, while the remaining matter "implodes", or crushes together, to form an incredibly dense nugget of matter.

A nugget the size of a matchbox would weigh a million tonnes!

But for all its interest, the Vela Pulsar isn't all that far away, in space terms, at 1600 light years. Forgetting the bodies in our own solar system, the nearest star in the "Milky Way"—our own galaxy—is 4 light years away, but the most distant is more like 17,000 light years.

Outside the Milky Way, and our own galaxy, distances multiply to the point where they completely boggle the human imagination, with millions of light years separating some entire galaxies from our own.

One of the frustrations which faced optical astronomers up to the nineteen-sixties was the fact that the two galaxies closest to our own by far—the Magellanic Clouds—were not accessible to the twelve major observatories in the World, all of them sited in the northern hemisphere. And even the centre of our own galaxy appeared, at best, low down in the northern sky, with very poor viewing conditions as a result.

If one or more comparable observatories could be set up in the southern hemisphere, they would have the enormous advantage of being able to view the two "neighbouring" galaxies. The centre of our own would be overhead, along with most of the globular clusters, ancient survivors of an early phase of our galaxy. Astronomers would be able to study a large number of other important bodies, along with objects and sources being pin-pointed in the southern sky by the very active band of radio astronomers.

It was this frustration and this need which led finally to the proposition that a large, modern optical telescope should be set up in Australia, with costs to be shared equally by the British and Australian Governments. The cause was taken up by the Royal Society and by the Australian Academy of Sciences and submitted to their respective governments in 1964.

Very fortunately, economic conditions in both countries were much brighter then than they are right now but, even so, it took three years of lobbying before agreement was reached to go ahead. Had the decision not been made then, the 1220m (4000 ft) mountain peak at Siding Spring would probably have remained notable only for its smog-free air, its tall gums and the bush birds that lived in them!

As it was, the telescope was officially opened by the Prince of Wales on October 16, 1974, by which time it was already evident that the AAT (Anglo-Australian Telescope) was going to meet or exceed its design criteria. If it had not, the British

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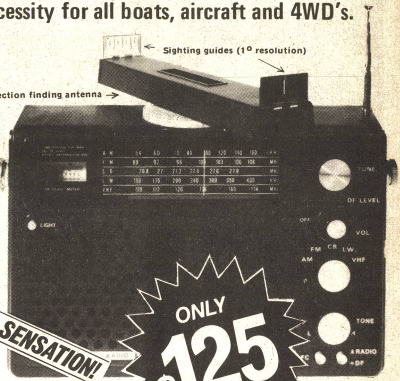

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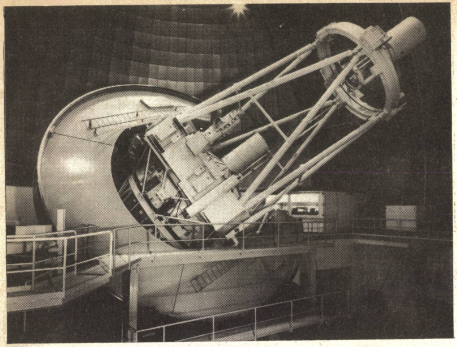


A general view of the telescope. The telescope tube carrying the huge 3.9 metre primary mirror is supported by the massive "horseshoe" mounting.

and the Australian Governments would have found themselves with a $16 million white elephant—and a very large one at that!

Ten years earlier, the Siding Spring site had been strongly supported by the Australian interests as the most practical of those considered. It already accommodated a number of smaller telescopes as an out-station of the ageing Mt Stromlo observatory at Canberra but, unlike Mt Stromlo, it was not cheek-by-jowl with a large and growing city.

Coonabarabran, a small town 32km away and on the inland plains 610 metres (2000ft) below Siding Spring, was large enough to ensure services and access but not so large as to create significant night-time glare or atmospheric fouling. Some problems would have to be anticipated from wind and from high level dust from the inland but records showed that, on average, night-time "seeing" was good, often very good, for about 1500 hours per year with additional periods of poorer quality.

A secondary advantage was that Siding Springs was not too remote from major radio astronomy installations: the huge radio dish at Parkes (240 kilometres), and the arrays of a different kind at Narrabri (160 kilometres).

Another view, supported strongly by Australia, was that the new telescope should take advantage of the very extensive design work which had gone into the telescope then being built on Kitt Peak in Arizona, USA.

Fundamental to the decision was the assumption that the basic mirror would have an effective optical diameter of about 3.9m or 150 inches. While this appeared to be modest by comparison with the 5m or 200-inch Mt Palomar telescope, it had become clear, even then, that modern electronic control systems and instrumentation applied to more modest but precise optics could literally open up new horizons.

The mirror itself is made of Cervit, a glass-like ceramic which is notable for its near-zero coefficient of thermal expansion. Supplied as a blank by Owens Illinois of Toledo, Ohio, its surface has since been polished to an accuracy of within one ten-thousandth part of a millimetre relative to the intended optical contour.

As if to dramatise the order of this figure, someone worked out that, if the mirror configuration had been scaled up to span the entire 29km between Siding Spring and Coonabarabran, the maximum deviation from the theoretical ideal anywhere on its surface would be less than 1 centimetre!

Unlike the usual mirror, the reflected image does not pass through the glass but is reflected directly off the surface, aided by a microscopically thin layer of aluminium (typically 120 nanometres thick).

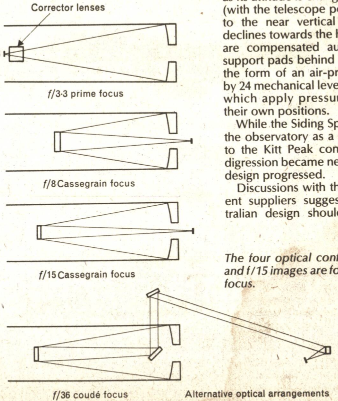
The aluminium layer has to be replaced at approximate 12-monthly intervals and the job is done within the observatory building. The mirror is lifted out of the telescope by an overhead hoist and carefully but thoroughly cleaned. It is then fitted like a lid to a huge chamber which is pumped down to a high degree of vacuum. At the appropriate time, about 90 aluminium filaments in the chamber are melted by passing current through them and, within a minute or so, the evaporating aluminium has coated the mirror surface.

Curiously, some early evaluation of the telescope and some of the earliest pictures were taken with the Cervit mirror in its uncoated state.

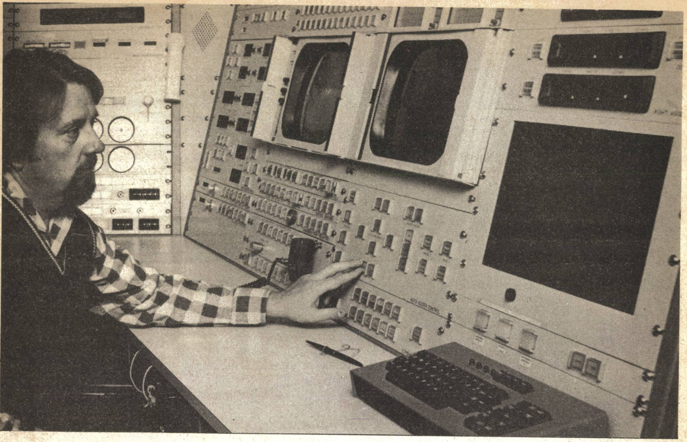
The main potential limitation to the resolution of the main mirror is its possible deformation by gravitational forces as its attitude is changed from horizontal (with the telescope pointing straight up) to the near vertical as the telescope declines towards the horizon. The forces are compensated automatically by 36 support pads behind the mirror, each in the form of an air-pressure piston, and by 24 mechanical levers around the edge which apply pressures depending on their own positions.

While the Siding Spring telescope and the observatory as a whole owed much to the Kitt Peak concept, considerable digression became necessary as the local design progressed.

Discussions with the optical component suppliers suggested that the Australian design should be based on a



The four optical configurations. The f/8 and f/15 images are formed at a common focus.



The control console of the AAT telescope. Once the required pointing data has been entered, the telescope will automatically find the correct position, centre the image, and provide automatic tracking of the object.

greater focal length (ultimately 12.7m or 500 inches) and this dictated a number of major changes: the telescope "tube" itself needed to be longer and heavier, and this called for an up-graded support structure to ensure adequate rigidity.

It also became impractical to change the optical configuration of the telescope by changing components within the tube; instead, provision was made to accommodate completely detachable top-ends, to be interchanged as necessary by means of a permanent overhead hoist—a job that takes about 30 minutes.

Out of this came the necessity for a much larger and heavier dome and a building underneath to match. In the ultimate, the observatory building for the AAT at Siding Spring turned out to be a very large structure: 37 metres in diameter to match the 500-tonne rotatable dome, the latter reaching to a height of 50 metres above ground level. Total weight? Around 7000 tonnes.

Inside the building, and physically isolated from it is an 18 metre (60ft) high central pier, which supports the actual telescope, the latter being gratifyingly free from vibration or other movement.

Between the core and outer shell are several levels served by lifts and stairs, and sufficient to accommodate virtually all the close support facilities and services: telescope fitments and modules, the electronically based control centre, electronic laboratory and service centre, mirror aluminising plant, photographic darkrooms, library, staff offices, visitors' gallery, etc.

Most of the space is air conditioned for most of the day but, as evening approaches, the dome is gradually brought to parity with outside ambient so that, when the shutter is opened to the evening sky, there will be no equipment traumas due to sudden changes in temperature and humidity.

In the biting night air of Siding Spring Mountain, one person at least must wish at times that the dome didn't need to be opened and that the telescope could view the sky through a plastic cover: the person whose turn it is to ride the cage in the very nose of the telescope tube to attend to the photographic plates and equipment.

The telescope is used in this "prime focus" mode when the ultimate resolution is required and, on this score, the AA telescope has been shown comfortably to resolve an artificial double star with a separation of 0.17" arc. In down-to-earth terms this is roughly equivalent to being able to distinguish between a couple of one-cent coins side by side 20km away!

Alternative optical configurations are:

- Cassegrain focus in which reflecting optics are placed part way along the telescope tube to re-direct the rays through a hole in the centre of the mirror, reaching focus just behind the mirror. Electronic sensing equipment, television type imaging equipment, etc, can be attached coveniently at this point, moving with the telescope.
- Coude focus, an extension of the Cassegrain approach but involving a series of reflections to bring the light beam out through the side of the tube to, if necessary, a fixed instrumentation point.

Precise optics would, of course, be virtually useless without similar precision in the equipment needed to point the telescope in the required direction at the required time, to drive it so as to follow the star field, all the time sensing the behaviour of the total system so as to apply minor corrections as necessary.

Virtually all the sensing is done electronically. The time reference is derived electronically and an Interdata 70 computer inter-relates this with the required pointing data, which is either punched in manually or derived from a card or disc store.

From the outset, the entire telescope system was designed for highly automated, remotely controlled operation, without need for visiting astronomers to concern themselves with how the equipment itself operates. Once the required position is entered, one presses the "GO" button and the rest happens automatically. The dome rotates on its own track to the required position and the telescope on its pedestal does likewise—something that happens so quickly and conveniently that it belies the intricacy of the operation.

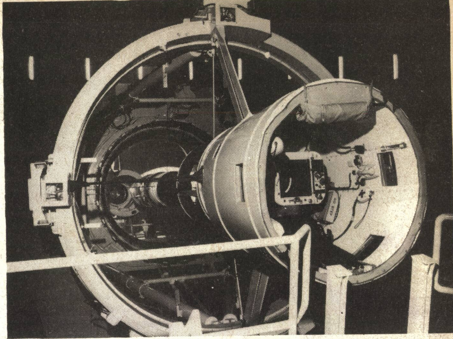
What is more, tracking of the space body proceeds quite automatically, with the feedback and servo systems coping with mechanical limitations.

Had the system been accurate to within 10 arc seconds, it would have been reckoned quite good, but the mechanics, instrumentation and control at the AAT have bettered this by about 4:1.

In addition, it is possible to program incremental movements accurate to about 0.1 arc second which are additional to the automatic tracking. This facility permits TV-style scanning of a body, or twin measurements with instruments like the Image Dissector Scanner, to compare radiation from an object with that from the sky immediately alongside.

To take advantage of this accuracy, observers should ideally be able to nominate the position of a body they wish to study to .1 arc second and here is where a significant problem remains to be solved. Star maps of the southern sky are just not that good.

It is for this reason that a companion telescope on the same mountain plateau, owned by the British Research Council, is occupied on a full-time mapping assignment. Using a 1.2m Schmidt camera telescope, it is piecing together a star map of celestial bodies with sufficient accuracy to serve as a pointing reference for its "big-brother"—with its penetrating but very narrow field of view.



View inside the prime focus cage at the end of the telescope tube. An operator rides in the cage to attend equipment when the prime focus mode is used.

NGC 5128: Centaurus A, a giant elliptical galaxy. Picture shows a "dust lane" leading out from the galaxy.

There's one other problem about the AAT at Siding Spring: there's only one telescope and any number of qualified people who want access to it to pursue their own particular lines of research.

So, inevitably, there's a queue of people lining up to use it.

Forty-five percent of the available time is available to British scientists, and the same amount to Australians; the remaining 10% is reserved for the AAT Director and is normally absorbed in checking, maintenance and the commissioning of new instrumentation and facilities.

British and Australian scientists have to convince a panel in their respective countries that the work they are doing justifies access to the AAT and its facilities. Further, that if they need to provide additional instrumentation, it will be compatible with the Siding Spring installation.

Once permission is granted the scientist and his team have to plan ahead to the last detail to ensure that there will be no foul-ups to prevent them getting the information they want, in a form that they will later be able to use.

It may be photographic—the result of lengthy exposures on specially sensitised plates.

Nowadays, however, there's a better than 90% chance that the image, or brightness, or spectral data will be collected by an image intensifier, a TV-like camera or other electronic instrumentation, transformed into digital form by the AAT's second Interdata 70 computer and recorded on magnetic tape. It's this precious tape that the scientist will carry away, to be analysed in the ensuing weeks in another place with another computer.

But what if it's a bad night, with rain and wind and cloud obscuring the sky?

Well, that's bad luck, because tomorrow is a new day and somebody else's turn to pray for one of those still, starry nights, when the stars are at their brightest.

In a way, it all seems so removed from traditional astronomy—rugged up to keep out the cold night air, peering through an eyepiece before setting up a camera, and then waiting patiently as the falling-weight mechanism does its best to move the telescope smoothly. And, if the night was overcast, you simply waited for tomorrow and another chance.

Now there are no eyepieces and no heavy coats, except for those who tend the gadgetry in the open dome.

The astronomer sits in an air-conditioned control room before a maze of buttons and readouts. He inserts a punched card and the telescope finds the position, centres the image, tracks it and does its other tricks automatically and with uncanny precision. It displays what it's looking at on a cathode-ray screen and spills its data through a computer on to a roll of magnetic tape that looks just like any other roll of magnetic tape.

Down there, in the control room, the distinction between optical and radio telescopes is indeed blurred.

Which brings us back to the point that they are both studying electromagnetic radiation from "bodies" in space. It's just a question of the wavelength!

NAKAMICHI

It is not so very long ago that the name Nakamichi first came to the notice of Hi-Fi enthusiasts.

The introduction of the Nakamichi TT1000 3 head Cassette Deck set entirely new standards of performance for a cassette recorder. In a similar manner the DT550 established performance standards previously not thought possible in a portable cassette deck.
Dr. Nakamichi's design philosophy was to produce equipment which would capture and reproduce pure uncoloured sound. The same philosophy has been applied in the greatly extended range of Nakamichi hi-fidelity equipment which is now available.

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INTERNATIONAL

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THE NAKAMICHI RANGE

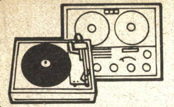
Nakamichi TT 1000	3 head Cassette System
Nakamichi TT 700	3 head Cassette System
Nakamichi 600-600B*	2 head Cassette System
Nakamichi 610-610B*	Control Pre-amplifier
Nakamichi 620*	Power amplifier
Nakamichi 630*	FM Tuner Pre-amplifier
Nakamichi 500	2 head Cassette Deck
Nakamichi 410	Pre-amplifier
Nakamichi 420	Power amplifier
Nakamichi DT550	Portable versatile Cassette System
Nakamichi 350	Portable versatile Cassette System
Nakamichi 250	Cassette Player
ADS200 & ADS2002	Miniature Hi-Fi Loudspeakers

**Combined make up the "System One" Rack console.*

Plus an extensive range of peripheral equipment — microphones, digital timers, reference pick up phono cartridge, headphones etc. Only accredited Nakamichi dealers (look for the sign 'Nakamichi Spoken Here') are provided with the Technical Bulletins essential to fully understand and demonstrate Nakamichi equipment. The Nakamichi warranty** applies only to equipment purchased from accredited Nakamichi dealers in the country of purchase.

***The Nakamichi warranty is transferable subject to the equipment being inspected at a nominal charge by any accredited Nakamichi dealer.*

N.S.W.: Convoy Sound W'loo Showroom 357 2444 • Convoy Sound City Showroom 29 1364 • Instrol Hi-Fi Pty. Ltd. 290 1399 • Riverina Hi-Fi 938 2663/4 • Russin Hi-Fi 799 2421 • Pitmans Radio & T.V. Wagga 25 2155 • Armidale Electronics & Audio Systems 72 4955 • **VICTORIA:** Allans Music (Aust) Ltd. 63 0451 • Encel Electronics Pty. Ltd. 42 3761 • Instrol Hi-Fi (Vic) Pty. Ltd. 67 5831 • Tivoli Hi-Fi 81 2872 • Omnisound 24 2428 • E & B Wholesale (Geelong) 9 6616 • Shepparton Hi-Fi 21 9006 • G.W. Williams 792 2843 • **A.C.T.:** Pacific Stereo 95 0695 • Duratone 82 1388 • **QUEENSLAND:** John Gipps Sound 36 0080 • Premier Sound Rockhampton 27 4004 • Targa Electronics (Cairns) 53 2715 • **TASMANIA:** Bel Canto 34 2008 • **WESTERN AUSTRALIA:** Audio Distributors 31 5455 Lesley Leonard 22 4304 • Albert's Hi-Fi (3 stores) 25 9993 • **SOUTH AUSTRALIA:** Blackwood Sound Centre 278 1281 • Ern Smith Hi-Fi 51 6351 • Allans Music (Aust) Pty. Ltd. 223 5533.



Hi Fi News

Nakamichi range continues to expand

During a recent visit to Sydney, Dr E. Nakamichi emerged as more than just a successful manufacturer of high quality audio/hifi equipment. He is still very much the enthusiast who now has the means to do some of the things that he—and other enthusiasts—most want to do.

by NEVILLE WILLIAMS

The fact that he makes frequent personal visits to Nakamichi distributors in various countries is an indication of his attitudes. His whole philosophy is to talk to customers and discover what they want, rather than to merely occupy an office in Tokyo and to manufacture the products he thinks they should have!

So, while Dr Nakamichi's brother was back in Japan looking after factory production and service, the Doctor himself was in Sydney, talking face to face with his authorised dealers from all around Australia.

He was then due to fly off to America to join his son Ted, who is deeply involved in the American operation. And also to commission a twin-engined executive aircraft, which will be used to keep in closer contact with Nakamichi retailers in that country.

A point which emerged from the sessions at Convoy International in Sydney was that the Nakamichi marketing philosophy deliberately avoids having the products on display by just any dealer willing to stock them. Dealers are appointed on the basis of their appeal to, and understanding of, the quality hifi market, and their potential ability to provide adequate back-up advice and service.

The close tie with hifi devotees is evident from the emergence of embryo Nakamchi clubs whose members share a common interest in high quality tape recording and reproduction. Some clubs are already forming overseas and Convoy International in Sydney are currently considering the degree to which they might be able to sponsor and support a similar Australian activity.

In the discussion with Australian dealers, one of the key words seemed to be "hobby". For sure, Nakamichi equipment could meet the most exacting professional expectations but the vast army of customers who used it to play or dub professional program material for their own pleasure had to be hifi "hobbyists".

The same applied to those who went to a great deal of trouble to record live performances, seeking to capture sound as it was heard by a listener on the occasion, and play it back with the smallest possible departure from that "occasional" atmosphere.

And here, Dr Nakamichi's philosophy is closely parallel to that behind the production of the Fulton discs, described in last month's issue, and referred to again in "Forum" elsewhere in this issue.

Dr N. tends to brand as "commercial" the sound assembled from multiple mics and multiple tracks, and perhaps "doctored" with equalisers and reverberators as well. His penchant is to set up his microphones (Nakamichi, of course) in such a way that they will capture sound as much akin as possible to what a listener in the room would hear and to put it straight on to tape with a minimum of signal processing.

Until recently, Nakamichi equipment had no provision for tone control and, while Dolby circuitry has been a commercial necessity, the whole emphasis of current effort is towards increasing tape headroom to the point where Dolby processing is also rendered redundant.

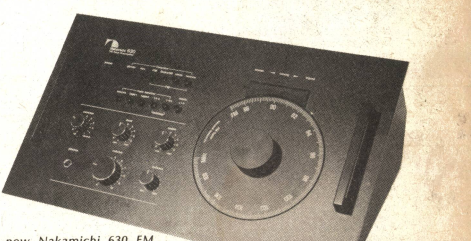
In fact, the lecturer made a brief mention of a new system of dynamic noise suppression recently developed in Europe, in which he was interested. Described as the best system to date for the purpose, it presumably operates only on replay, gating the bandwidth to match the demands of the signal and therefore shutting out noise in the unused part of the spectrum. The idea is not new, of course; the merit lies in how well it is done.

In pursuing his "hobby" at the enthusiast level, Dr Nakamichi has more than a head start on most of his customers. Recording equipment is no problem, of course; his company makes it on a large scale.

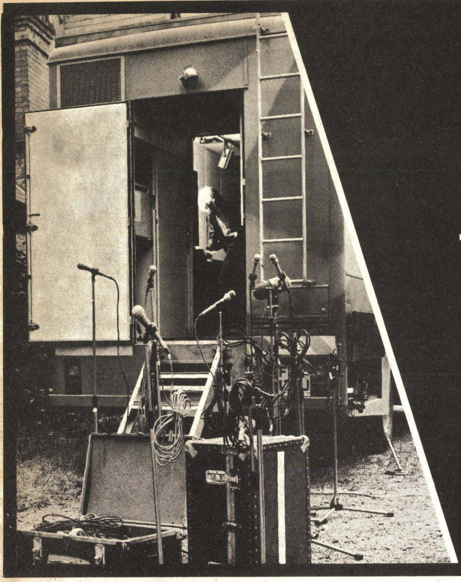
More than that, he is a competent harpsichord player, and has gathered around him a group of other musicians who share his interest in baroque music. They are able to play and record their music in reasonably modest auditoria, as often as they fancy.

In fact, the Nakamichi Company has just recently completed a small auditorium in Tokyo expressly for intimate performances. It will accommodate an audience of about 100 people and Nakamichi customers will be given the opportunity, by arrangement, to make their own direct recordings of the music being played. And being baroque in nature, very little of it is subject to copyright or royalty.

A small studio is already operating along these lines in New York, with a larger one planned, and similar arrangements are in train for Los Angeles.



The new Nakamichi 630 FM tuner-preamplifier. A detailed review is scheduled for our next issue.

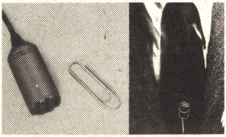


Stones' Rolling Studio.

A complete recording studio in a van? For Mick Jagger, it's almost a necessity. Mick and the Stones can be inspired to produce their next hit anytime; but when they're on tour or vacationing, the best recording studios aren't always around the corner. For these moments of midnight inspiration, the Stones rely on their Shure-equipped mobile studio for the unmatched recording perfection they insist upon. Whether in a recording session or on stage, the Stones' Shure SM53, SM58, SM5C, SM33, and SM54 microphones are their assurance of consistent quality and natural sound.

Three more new Microphones from the Shure range.

Model PE52 Vagabond Close-Talking Microphone



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Hifi in a shoebox—Canton LE 250

With the improbable brand name of "Canton", these ultra-compact loudspeaker systems are manufactured in the Federal Republic of Germany. They could be the obvious choice for people wanting good quality sound reproduction in boats and recreational vehicles. The Canton LE250 is a two-way system measuring just 300 x 175 x 130mm.

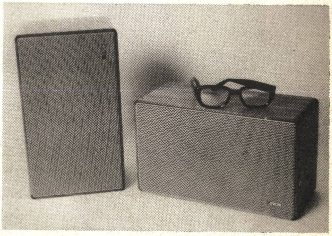
Ever since the days of the Goodmans Maxim, there has been no doubt that high quality sound can be obtained from an enclosure which is barely the size of a shoebox. Even so, small enclosures have never really taken a hold on the market, in spite of the cramped quarters in which many people are forced to live.

Now there is a new trend which could create a sizable market segment for very compact loudspeakers. That is the very healthy and growing market for recreational vehicles. Launches, caravans, camper vans and larger "mobile homes" all present the need for good quality sound reproduction which cannot be met with larger conventional loudspeaker systems.

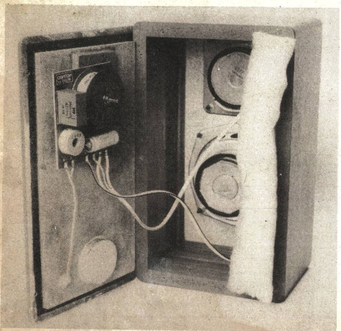
Apart from small size, there is another factor which works to the advantage of systems like the Canton LE250. The extended bass response (which may be real or imagined) of larger conventional systems cannot be realised in the confined space of most recreational vehicles. Nor can it, for that matter, be realised in the average small living room of typical homes and home units.

Overall enclosure volume of the LE250 is roughly the same as the original Maxim but, as our photograph shows, it is not tightly filled with acoustic wadding, as was the Maxim. Nor is the woofer quite as small. A half-section crossover network centred on about 1600Hz gives 12dB/octave slopes to the woofer and tweeter, above and below the crossover point, respectively.

The enclosure is ruggedly constructed and well sealed. Two recessed holes in the rear panel allow the unit to be hung on a wall, vertically or horizontally. Cabinet finish is walnut veneer or matt white. The speaker cable is 5m long and fitted with a polarised 2-in DIN plug.



Small size of the Canton LE 250's belies the impressive sound quality they can produce.



The enclosures are well made and tightly sealed. Photo shows the modest amount of filling used.

We approve of the perforated aluminium grille. This offers positive protection to the loudspeaker in the event of mishaps, although it may not appeal to those who wish to look at the drivers rather than listen.

Nominal impedance of the LE 250 is quoted rather vaguely at 4 to 8 ohms. Our measurements indicate a mean value of about 3.6 ohms. At the bass resonace of 90Hz it rises to a peak of 17 ohms and again at the crossover frequency of 1600Hz to a value of 14.5 ohms. In between it falls to a low of 2.9 ohms at 200Hz. This latter impedance value could cause problems with some amplifiers not specifically rated for 4 ohm loads.

Efficiency of the system is on a par with typical loudspeakers while the power handling is adequate to handle program output of amplifier up to about 40W per channel. This combination means that the LE 250 can be driven to quite impressive sound levels in most rooms.

Sound quality is also quite impressive. On most music signals the LE 250 gives very acceptable wide range sound, although it tends to suffer by comparison with the much larger systems when playing heavy rock or pipe organ music. there is a tendency for the system to emphasise tape hiss and record surface noise, but this can be tamed with judicious adjustment of the treble control on the amplifier.

In short, a pair of Canton LE 250's must have considerable appeal to those with little space to spare, which would mean that larger loudspeakers could not be justified.

Suggested retail price for the LE 250's is $265. Further information and demonstrations can be obtained from the Australian distributors, Photimport Pty Ltd, at 69 Nicholson Street, East Brunswick, Victoria, 3057 or interstate branches (L.D.S.)

Devaluation rather upset Pioneer's planning with their budget-priced Centrex range, by adding about $100 to the price of the complete systems. Seeking to fill the $600 gap thus created, Doug Bell, Manager of the Centrex Division, has announced the System 520, priced at $599.00. The new 3-in-1 unit includes an AM/FM stereo receiver with normal control facilities and a power output of 12W per channel. A belt-driven turntable with auto shut-off is accommodated under a hinged cover, while a front-loading cassette player/recorder provides the tape facility. A pair of 2-way speaker systems forms part of the system, while a separate cabinet is available as an extra. (Pioneer Electronics Aust Pty Ltd, 178 Boundary Rd, Braeside, Vic 3195).

and tape monitor channels.

listed also for the push-button controlled auxiliary input and tape monitor channels.

A notable inclusion in the 630—the result of user demand—are separate bass and treble controls and a "contour" control which is Nakamichi's answer to the call for a "loudness" facility.

Physically, the 630 FM tuner/preamplifier has the "instrument" look, the dial being a simple round plate marked directly in MHz. LED indicators above the dial indicate signal strength, stereo broadcast, proper tuning, or direction of mistuning. Rotary knobs control the preamplifier section, together with two rows of push buttons.

For those who already have an adequate FM or AM/FM tuner, the Nakamichi alternative is the 410 preamplifier. Both are intended to mate with the quite new 420 power amplifier delivering up to 60W RMS per channel at .05% distortion.

And, just for good measure, the Nakamichi press kit contained details of a whole range of hifi peripherals:

MC-1000 Reference pickup: a low impedance moving coil designed with a claimed frequency response to 65kHz.

MCB-100 phono transformer: ratio 1:20, response to 65kHz and suitable for typical moving coil cartridges.

FG-100 stylus force gauge.

HP-100 headphones: 20-20,000Hz, 8 ohms, 0.8% distortion at 110dB SPL.

CM-1000 microphone: professional studio condenser microphone with external power supply and line facilities.

CM-300: high performance electret microphone.

CM-100: economy electret microphone.

CM-100x3: the CM-100 packaged with additional heads for a choice of directional patterns.

DM-1000: high performance dynamic microphone.

DM-500: economy but still good performance dynamic microphone.

So the list goes on: a reference monitor loudspeaker system, remote control units, power pack, tape head demagnetiser, equipment carry bags, digital program timers and, of course, tape cassettes.

All told, quite a line-up!

(For details of Nakamichi equipment: Convoy International Pty Ltd, 4 Dowling St, Woolloomooloo, NSW 2011. Tel: Sydney 358-2088).

CUERAC FOR EXPORT?

Our January issue contained an article on the Australian developed "Cuerac" automated program source for broadcast stations. In this system, musical numbers are pre-recorded on NAB "A" sized cartridges, which are then slotted into racks holding 500, each one selectable for play in associated replay units. For automatic programming, the system operates according to stored instructions, fed into the integral computer via an ASCII keyboard.

Up to five rack units can be interconnected, giving an automatic programming facility with an instant-access library of 2500 cartridges. Cartridges can be substituted individually at any time, allowing the working "library" to be constantly up-dated.

According to Managing Director Ralph Medding, Consolidated Electronics Industries is looking for Australian leasing or sales of about $1.2 million in the first year. However, exposure to the National Association of Broadcasters in Washington, and at the Montreux Exhibition in Switzerland should generate overseas interest with potential sales up around the $2 million mark.

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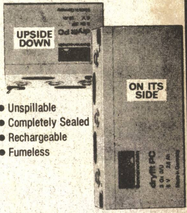

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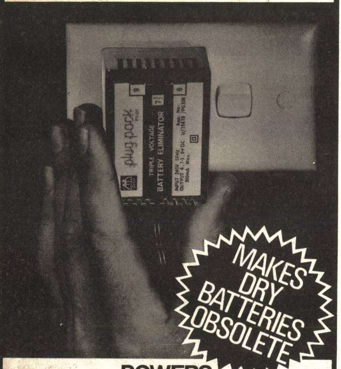

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field, full facilities with provision for stereo mic mixing plus a third "blend" mono mic channel.

350: A versatile and compact portable recorder/player for on-the-spot use. Well suited, with separate speakers, for use in a car or in a restricted caravan or domestic situation.

250: A replay only deck intended primarily for boat, caravan or car, using external compact loudspeakers. Normal facilities, plus tape equalisation switch, and better than average performance specifications.

Additional to these tape decks are the well known Nakamichi control preamplifier model 610 and its companion power amplifier model 620. Both have sloping panels to match, enabling them to be used on a cupboard top or shelf. Alternatively, they can be rack mounted with the model 600 cassette deck to form Nakamichi's "System 1", a popular choice for the well-heeled audiophile who prefers the professional look in his listening lounge.

Completely new to the Nakamichi range is the model 630 FM tuner/preamplifier—a logical package for the dedicated hifi enthusiast.

Explaining the design philosophy for the 630, the covering brochure points up the problems of compressing an ostensibly high performance FM into the limited space available inside the usual high-power integrated receiver/amplifier. A good case can be made, therefore, for having a separate tuner or, as here, combining it with a high performance preamplifier, with phono, auxiliary and tape inputs.

In line with these general aims, the specifications for the tuner are ambitious, with a stereo distortion figure of 0.08%, signal/noise ratio better than 65dB (70dB with Dolby), separation 55dB at 1kHz, and sensitivity (IHF) 1.5uV for 30dB of quieting.

No provision whatever appears to have been made to cover the AM broadcast band.

The preamplifier specifications are also impressive, with selectable phono sensitivity down to 1mV and a maximum permissible input level of 250mV. Response is quoted as within 0.3dB of RIAA while equivalent noise (IHF) is at −80dB ref 1mV. Distortion is given as .003% up to 10kHz. Excellent figures are listed also for the push-button controlled auxiliary input

High performance, modest price:

Referred to by the makers as their "black beauty" SL-2000, this new Technics turntable has been expressly designed for the hifi enthusiast market, while still being moderately priced at $199, recommended retail. It employs a diecast turntable with integral stroboscope, a direct drive system with electronic control centred in a single IC, and vernier speed controls on the two settings, 33 and 45 rpm. A precision tone-arm is fitted and a new moving magnet cartridge. Wow and flutter is 0.045% RMS and rumble −47dB or −70dB, depending on the method of measurement. (For further information: Haco Distributing Agencies Pty Ltd, 57 Anzac Parade, Kensington, NSW 2033.)

For those Nakamichi customers not able to take advantage of these direct recording facilities, there are plans afoot to make master tapes available to Nakamichi distributors, who may then be able to offer their customers or club members the chance to make their own 1:1 copies, with royalty involvements (if any) already covered.

Consideration is also being given to building up a catalog of high quality master recordings and marketing normal speed copies on cassette. While necessarily expensive, such recordings should represent "state-of-the-art" for present-day cassettes.

One of the intriguing aspects of the Tokyo studio is that it contains an organ which must be the most intimate marriage yet of pipe and electronic technology.

It has pipes, 72 of them, but there is no blower and no wind. Instead, each pipe is excited by a loudspeaker, with an 8-inch speaker to drive each of the larger pipes. Ahead of the loudspeakers is an array of electronic organ circuitry designed to make the pipes sound with the desire tone colours. The console itself reverts to tradition in terms of layout and appearance.

Conn have exploited the idea in a modest way, for many years, with their loudspeaker/pipe system but the organ in the Nakamichi studio, reportedly built by Yamaha, carries the principle much further. Mere mention of it was sufficient to trigger a lengthy discussion amongst our technical staff—but that is another subject.

The press kit distributed at the Convoy International seminar emphasised how the Nakamichi range has grown since the name was first noted on the hifi horizon. No less than seven cassette systems were displayed:

1000 II: the Company's top-of-the line model with three heads and closed loop tape drive, intended for professional or advanced enthusiast use.

700 II: Number two in the line-up, 3-head and closed capstan design but styled and down-priced for top quality domestic use.

(In both cases, the suffix "II" indicates a later version of the basic design, already well known to hifi buyers. Having built up an identity around their System 1000 and System 700, etc., Nakamichi feel that it is logical to maintain it and to add Mark numbers.)

600: A high quality 2-head cassette recorder/player, with inclined front panel, ideal for prestige domestic applications.

500: Conventionally styled 2-head cassette recorder/player with horizontal control panel but with a multiplicity of features including stereo mic/line mixing and blend mixing for a third mono microphone.

Moving out of the home and studio, Nakamichi list three portable cassette decks:

550: Designed for exacting use in the

AKAI: NEW TUNERS & AMPLIFIERS

Akai Electric Co., Ltd., the well known Japanese hi-fi equipment manufacturer, has announced their 2000 Series, a complete new line of integrated stereo amplifiers and AM/FM stereo tuners.

The five new models, three amplifiers and two tuners, have identical external dimensions and attractively finished brushed aluminum front panels so that any pair will combine harmoniously.

The new amplifiers, AM-2400, AM-2600 and AM-2800, have output power ratings of 40, 60 and 80 watts respectively. The ratings, based on the U.S. disclosure rule, refer to minimum RMS power per channel, both channels driven, at 8 ohms, from 20 to 20,000 Hz, with no more than the specified total harmonic distortion.

All three employ an advanced pure complementary OCL direct coupled circuit arrangement which accounts for their extremely low distortion ratings and excellent stability over a wide power bandwidth.

They also include connections for two complete tape input/output systems, with tape one duplicated by a DIN-type PEC/PB connector. Tape-to-tape dubbing is possible in either direction, multiple source inputs allowing assembly of very elaborate systems around the new amplifiers. Subjective "loudness" switches are featured on the two higher-priced models, with two-stage attenuators; all have large handy volume controls and high and low filters for program "denoising".

Control flexibility rises with the model numbers. High and low filters in the AM-2400 have fixed turnover frequencies, but the AM-2600 and AM-2800 have two-way selectable turnover points and the AM-2800 also has a midrange or presence control in addition to the standard bass and treble controls. The AM-2600 and the AM-2800 also have output power meters with 3W and 100W scales that can be selected by means of a meter range switch.

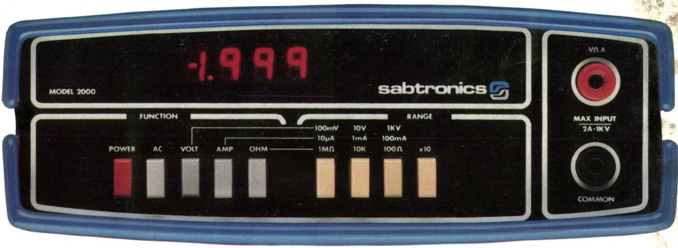
At first glance, the new tuners, AT-2400 and AT-2600, would appear to be identical—the same generous complement of controls, signal strength and zero-center tuning meters, high blend and FM muting switches, FM muting variable adjustment, LED pilot lights for power, FM stereo and AFC, slim dials calibrated in linear intervals for FM, large-flywheel tuning mechanism and smooth pointer travel.

Both tuners have newly-developed phase lock loop circuitry in the FM MPX section replacing the now common PLL chip and assuring even greater channel separation.

The major distinction between the two is of especial interest to FM-to-tape recording enthusiasts. The AM-2600 signal strength meter can be switched to function as a deviation meter which then indicates the FM station's modulation depth in percent which is important when setting recording levels on a tape deck.

The new components, which complement Akai's full line of hi-fi receivers should enable the company to make a strong impact on the sophisticated separate component market.

We've just made the impossible... a professional 3½ digit DMM Kit for less than $60.



The Sabtronics Model 2000 is an impossible $59.95! And that price still includes phenomenal accuracy, range and professional features.

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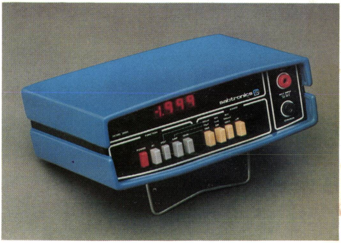

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AC volts in 5 ranges: 100μV to 1000V.
DC current in 6 ranges: 10nA to 2A.
AC current in 6 ranges: 10nA to 2A.
Resistance in 6 ranges: 1Ω to 20MΩ
Input Impedance: 10MΩ
Display: 9mm (.36″) LED.
Power requirements: 4.5 VDC to 6.5 VDC (4 "C" cells - not included).
Size: 8″W x 6.5″D x 3.0″H. (203W x 165D x 76H mm).

ORDERING INFORMATION

The prices as listed are in Australian dollars and do not include any tax or duty which may be levied upon receipt of the goods. Please send remittance in the form of a Bank Draft for an equivalent amount in U.S. dollars. If an International Postal Money Order is used, include original receipt with order to insure prompt shipment.

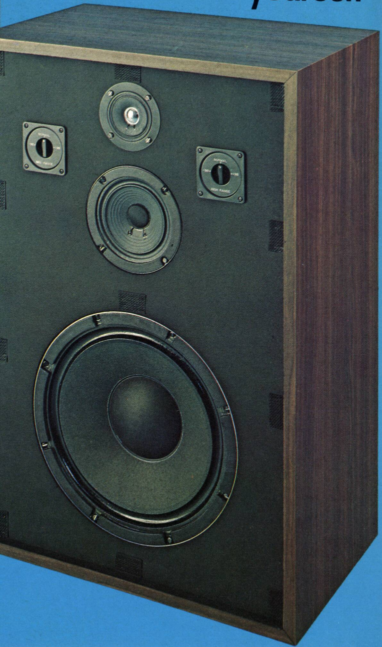
TO: Sabtronics International, Inc.,
P.O. Box 64683, Dallas, TX 75206, U.S.A.
Please send via insured airmail:—
__________ (qty) Model 2000 DMM kit(s)
@ A$59.95 each __________ subtotal.
Insurance, postage and handling:
A$9.00 per unit __________ subtotal
Amount enclosed A$ __________ *TOTAL
Please print or typewrite
Name ______________________________
Address ______________________________
City ______________________________
____
*I have enclosed the U.S. dollar equivalent of the A$ total.

Playmaster *3-Way Speaker Systems*

-and you build them yourself

Designed by
Neville Williams
Editor in Chief
Electronics Australia

3/53L 10" 3 Way Speaker System – 53 Litre Compact Size



3/75L 12" 3 Way Speaker System –75 Litre Capacity at an Economical Price

3-53L 10˝SPEAKER SYSTEM	**$189 25 PAIR**
3-75L 12˝SPEAKER SYSTEM	**$254 PAIR**

Superb Sound

If there is one thing that stands out about these speakers; it is this:
They look as good as they sound — and that is absolutely superb!
From the craftsman-made cabinet kits to the fully imported speakers, cross-over networks and controls, these speakers look and feel 'expensive'. Yet, because you put them together yourself, you save a good proportion of the labour cost involved in most commercially built speakers, so the cost is surprisingly low.
Neville Williams, designer of the speaker system, and Editor-in-Chief of Electronics Australia, puts this forward: "We'll back it against many of the systems in Hi Fi showrooms carrying a much higher price tag . . ."
What more recommendation could you need?

FEATURES:

- **Very easy to build (instruct. supp.)**
- **Incredible performance & sound**
- **Professional appearance**
- **Quality foam grilles supplied**
- **Choice of sizes to suit surroundings**
- **Equivalent units much higher price**

3-75L

12" SPEAKER SYSTEM $254 pair

This system consists of a pair of our C-2042 speaker kits, plus a pair of beautifully crafted 75 litre cabinet kits. Full instructions supplied — you need only a few hand tools & a tube of glue to complete the system in less than 2 hours. For full details see the May 1977 issue of Electronics Australia
This system will handle up to 80 watts peak at 8 Ohms.
External dimensions approx. 717H x 475W x 293D mm;
Finished in simulated walnut veneer and supplied with expensive foam fronts.

ORDER AS FOLLOWS

Cat. C-2042 Speaker Kit (pair)	**$130.00**
Cat. C-2622 Box Kit (pair)	**$124.00**
Total Systems Price (pair)	**$254.00**

3-53L

10" SPEAKER SYSTEM $189.25 pair

Very similar to the 3/75L system but more compact. The ideal system where space is at a premium.
External dimensions are approx 620H x 393W x 293D mm.
Will handle up to 60 watts peak into 8 Ohms.

ORDER AS FOLLOWS

Cat. C-2044 Speaker Kit (pair)	**$99.75**
Cat. C-2624 Box Kit (pair)	**$89.50**
Total system price (pair)	**$189.25**

Note: Speaker kits and box kits are available separately if required. Order by catalog number.

We missed some out . . .

Even though we delayed our catalog by 1 month just to get the very latest products, some were so new they missed the bus! So here are some of our latest lines — and a couple of catalog lines at special prices!

full color 5.00

MIDLAND T-SHIRT OFFER

Not just for Midland owners — you can wear one even if you'd like to own the best!
T-shirt comes in 3 sizes (med. large & ex large) and features 'Mr CB' —C.W. McCall.
Let 'em know you're a CB'er.
Cat D-9100 . $5

Sorry — Linda is definitely not for sale . . .

CB RF Output Trans.

2SC1306
2SC1307

fr. 4.50

We've got 'em . . .
Probably the most popular RF power transistors in Australia at the moment — and also the scarcest! But we have some; a strictly limited supply. It won't last long, so get some spares now. You never know when you might pop your cork!

2SC1306	**(12W M) Cat Z-2501**	**$4.50**
2SC1307	**(25W M) Cat Z-2502**	**$6.50**

FANTASTIC NEW IDEA FOR ALL CAR RADIO OWNERS . . .

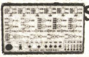
23.95 ripper

Sick of morons doing sculpture on your car radio antenna? Now, you can solve it once and for all with this unique antenna. Very short, fully retractable, and has its own in-built amplifier to increase gain. Extends to just 38cm, requires only 14mm hole. Ideal for all drivers; country or city. Works with any negative earth car.
Cat. A-7304 $23.95

$105 VALUE!

FANTASTIC MINISCAMP: New ucomputer from EA. 256 bit, expandable to 1k at low cost. Learn programming, how computers work — start your career! **Cat K-3446 , $105.00**
Schools: Special offer for orders of 5 or more with tax ex. the price is only **$87.65 each.**

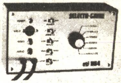
MINISCAMP OUT OF YOUR DEPTH?
Try the digital logic trainer. Learn all about logic basics or use as a breadboard for trying out ideas. And for a short time save a massive $26 on our cat. price — thats 27%!
Cat K-3010 .. .. .. 25 UNITS ONLY $69.00



$69 save 25%

AMATEURS & CBers:
See you at the Amateur Radio Expo 77 at the Wireless Institute, Crows Nest, on Saturday, 4th June. We'll be there!

TV GAME KIT (UPDATED!)



$49.50
Cat K-3432

IMPORTANT CHANGE TO OUR TV GAME KITS — NOW EVEN BETTER!

All of our TV game kits are now being supplied with the very latest G.I. AY-3-8550 integrated circuit , which allows **2-way movement of bats,** at no extra charge!

In the standard game, this IC will work as normal — but with the addition of two 100k pots (or better still a pair of joystick controls) you can have horizontal movement of the bats as well as vertical — much more dynamic! This new IC will also fit existing TV games so anyone who has previously bought our kits and wishes to convert, this is very easy. It simply plugs into the same socket.

Extra parts are as follows:

100k linear pots (2 req.) Cat R-1800	**70c**
100k joystick pots (2 req) Cat R-1976	**$4.75**
AY-3-8550 IC Cat. Z-6850	**$19.75**

DICK SMITH CUSTOMERS PLEASE NOTE:

Our stores will be closing for annual stocktake at the end of the financial year. Stores will close as follows:

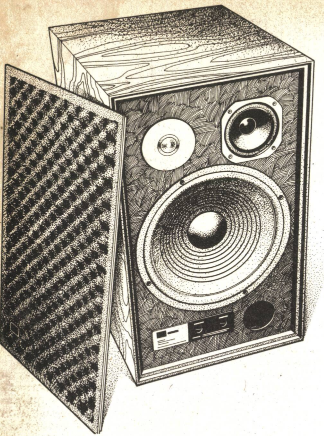
Store	Thursday 30/6	Friday 1/7	Saturday 2/7
Gore Hill	Closed	Open	Open
B'town	Open	Closed	Open
York St	Open	Open	Closed
Melbn	Close 2PM	Open	Open
Brisbn	Close 2PM	Open	Open

We apologise for any inconvenience.

DICK SMITH ELECTRONICS GROUP

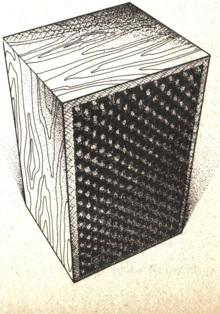
VISIT YOUR NEAREST STORE:
SYDNEY — 125 York St, Ph. 29 1126
BANKSTOWN — 361 Hume Hwy. Ph. 709 6600
GORE HILL — 162 Pacific Hwy. Ph. 439 5311
MELBOURNE — 656 Bridge Rd, Richmond. Ph. 42 1614
BRISBANE — 166 Logan Rd, Buranda. Ph. 391 6233
MAIL ORDERS: P.O. Box 747, Crows Nest, N.S.W. 2065.

WE HAVE DEALERS ACROSS AUSTRALIA. PHONE YOUR NEAREST STORE FOR THE DEALER CLOSEST TO YOU.

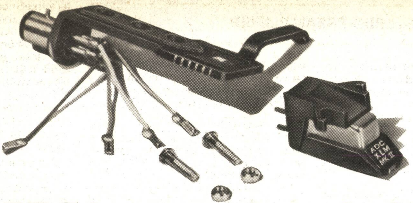


JBL's new L166.

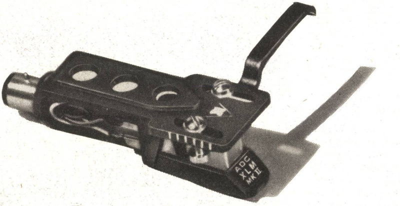
It's the most accurate loudspeaker JBL has ever made. The three-way L166 combines a new hemispherical high-frequency radiator with a new low-frequency transducer to deliver really impressive power-handling capability, super-wide dispersion and deep, tight bass. It has the most acoustically transparent grille ever developed. If you haven't heard the L166, you haven't heard nothing.



JBL



Now ADC frees you from the job of mounting the cartridge on the shell.



Introducing the pre-mounted ADC cartridges.

The "Uni-Head" is solidly engineered. It is a beautifully styled and tooled accessory. And it fits into practically all manual tonearms and many of the semi-automatic players.

Illustrated is the ADC XLM MKII which is the top of any line stereo cartridge with all the great ADC unique features:

- Nude elliptical stylus
- Low mass moving system
- Induced magnet principle
- One gram tracking – or less

Other cartridges available with the pre-mounted 'Uni-Head' (and the respective recommended retail values of each) are: the XLM Mark II-P, $120.00; the VLM Mark II-P, $100.00; the QLM-36P Mark II-P, $65.00; the QLM-32P Mark II-P, $55.00 and the QLM-30P Mark II-P, $43.00. The 'Uni-Head' is available separately.

ADC

Audio Dynamics Corporation
A BSR Company.
Monarch Works Anne St. St. Marys
Postal Address: Box 272 St. Marys NSW 2760 Australia
Telephone 623 0375/6. Telegrams "BSR" St. Marys Telex 23159

COMPTON BSR138

Dynaco PAT-5 stereo preamplifier

Nowadays separate stereo preamplifiers are comparatively few and far between, and intended for use in the more elaborate hifi systems. Such a unit available in kit form is therefore rare indeed. The Dynaco PAT-5 is one of the few such units available in Australia.

The Dynaco PAT-5 is expressly intended to drive any of the Dynaco range of stereo power amplifiers, such as the Stereo 150 reviewed in these pages last month. It is also compatible with any other stereo power amplifier requiring 1V or more for full power output.

In the country of origin, the USA, the Dynaco PAT-5 would appear to enjoy a great following—something of a cult in fact—amongst keen audiophiles. There would appear to be a number of reasons for this, apart from any technical merit in the circuit design. First, it is one of the few stereo preamplifiers available in kit form and it is made in the USA.

Another reason for its appeal is simple styling with plenty of control flexibility. Finally, the design lends itself to modification and "improvement", which is a strong temptation for many kit-builders.

So these reasons at least partly explain the continued success of a relatively simple and in some ways, old-fashioned design, in spite of very strong competition from Japan. In Australia, that competition may well be stronger since the Dynaco is no longer on home ground but has to face import tariffs and other costs.

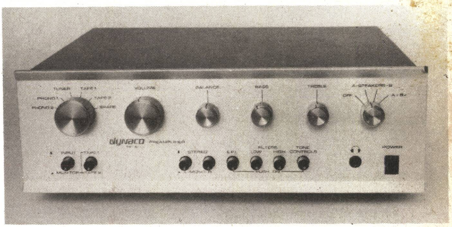
Since the front and rear photographs show the extent of the control facilities and the input and outputs we shall comment only briefly upon them. The tone controls can be switched out of circuit with the tone control button. The "EPL" button allows use of an external graphic equaliser and/or dynamic noise reducer.

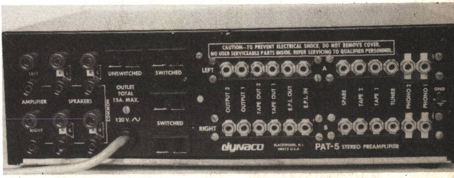
While the arrangement of the control facilities is effective and logical, the overall presentation is marred to some extent by the feel of the controls. Hifi buyers have come to expect potentiometers which rotate with silky smoothness, switches with just the "right" snap action and so on. The sample PAT-5, by comparison, had control knobs which were less than silky smooth in rotation. Perhaps we should add that our sample was a well-used demonstration unit.

Removing the top cover of the PAT-5 reveals a surprising interior. Instead of just having one or two PC boards and a minimum of wiring, there are five vertically mounted PC boards with a mass of interconnecting wires. There are two separate phono preamp PCBs and two PCBs for the high level and tone control circuitry. The remaining PCB is for the regulated supplies.

The chassis is divided into two compartments. On the left (looking from the front) are the four preamplifier boards and the signal switching facilities. Because it is well isolated from the mains wiring and loudspeaker switching circuitry, the design is able to obtain adequate signal to noise ratio without the use of shielded cables.

The crowded interior with its mass of wiring explains why the design lends itself easily to modification—the two channels are physically (although not electrically) separate and it is possible to "break into" the circuitry at almost any point.





Circuitry in the PAT-5 is relatively simple. A two-stage preamp running from a single 42V rail provides the initial preamplification and equalisation for the phono inputs. The amplified phono signals plus high level inputs are then fed to the Selector switch and thence to a two-stage buffer circuit.

From there, the signals are fed via the stereo/mono switches, passive low filter, balance and volume controls, to the two-stage active high filter. Finally, it goes to an integrated circuit stage which provides the tone control facility. Overall semiconductor complement is 13 transistors, two integrated circuits (LM301), three zeners and four rectifier diodes.

An interesting, if controversial, feature of the PAT-5 is that it is intended to be permanently switched on. As normally wired, the power switch only controls the power to the two-pin power outlets on the rear panel. In fact, if constructors conform to normal Australian practice, these sockets will not be used.

The idea behind the "permanent power" mode is to prevent switch-on thumps being fed via the amplifier to the loudspeakers. If the user wishes to switch the preamplifier off, Dynaco warn that,

DYNACO PAT-5 STEREO PREAMPLIFIER

at the next occasion of use, the preamplifier must be turned on ten seconds before the power amplifier to avoid loud switch-on transients.

We are surprised at this lack of refinement. Careful circuit design should largely prevent switch-on transients but, if that is not entirely effective, a switch-on muting circuit can be added. No doubt some enthusiasts will do just that.

Because the PAT-5 will normally be purchased in kit form it is possible to modify the phono preamplifier to suit particular cartridges. For example, one set of inputs can provide higher gain and high input shunt capacitance while the other pair of inputs can provide low capacitance and less gain. To this end, Dynaco have provided tables of optimum load capacitances for most magnetic cartridges and cable capacitances for most turntables. This allows the constructor to provide the necessary shunt capacitors across the input switch. Changing the gain means switching a resistor in the feedback loop.

There is one drawback with the variable gain facility – that of switching transients. The result is that, unless the volume control is at zero setting, switching between the phono inputs delivers a very loud bang from the loudspeakers. Dynaco warn against this themselves. We are of the opinion that unless cartridges with markedly different outputs are likely to be used, the variable gain facility would best be deleted.

Our tests on the PAT-5 were performed in conjunction with a Dynaco stereo 150 power amplifier referred to previously. Listening tests showed that the combination has ample gain and control range. We were very impressed with the extended bass response, which showed up on some recordings of pipe organ. The bass was noticeably better than obtained with some other amplifiers which were ostensibly equivalent in performance. More on that later.

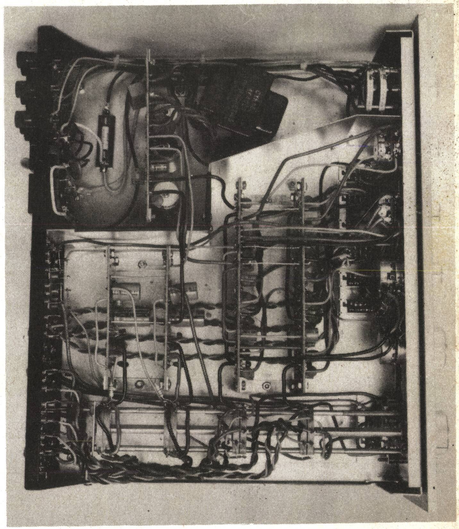
We also gained the impression that the phono preamplifiers were not as quiet as we have come to expect. Also, the unit appeared to be sensitive to mains-borne or mains radiated interference.

Our performance tests quickly revealed the reason for the apparent extended bass response—it is indeed extended. Frequency response of the high level inputs is within 1dB from 5Hz to 90kHz. The RIAA equalisation is within 0.5dB from 20Hz to 20kHz. It is this close adherence to the RIAA curve at the extreme low end which explains the audibly extended bass.

Now this can be very satisfying when listening to records of pipe organ or the occasional heavy rock disc, but it can cause problems with discs having a high rumble content and/or surface ripples or warps. Dynaco have provided a partial answer to this problem with the Low filter, but it starts to roll off at 100Hz with a slope of only 6dB/octave.

By contrast, the High filter has a slope of 15dB/octave and is quite effective in reducing tape hiss, particularly on program which does not have a lot of high harmonic content.

For a pair of phono inputs with a sensitivity of 2mV for 1 volt output at 1kHz, the overload margin is good at 120mV. The signal-to-noise ratio is adequate but certainly not the best we have obtained at 66dB unweighted with respect to a 10mV signal at 1kHz, with a typical cartridge connected. This figure improves by 3dB with short-circuited inputs but that is hardly relevant.



Signal-to-noise ratios for the high level inputs was 71dB with respect to 1 volt output. With volume control at zero setting the figure improved to 73dB. This reading was mostly hum.

At normal signal levels harmonic distortion was unmeasurable with our equipment. However, by driving the unit to a maximum of 9 volts into a 22k load we were able to measure it at less than 0.05% at 10kHz. No problems.

Separation between channels for the high level inputs was 56dB at 10kHz, 69dB at 1khz and 71dB at 100Hz. These figures were obtained with a resistor of 4.7k loading the undriven channel input. As such, the figures are excellent and ensure that there is little likelihood of the separation between channels of any source being degraded by the PAT-5.

Our summary of the Dynaco PAT-5 is equivocal. On the one hand , it will have considerable appeal to those searching for the lowest octave of the bass register and to those wanting to build a flexible preamplifier, with the possibility of incorporating their own modifications.

On the other hand, some refinement of the circuit seems desirable to avoid loud transients at switch-on and when using the Selector switch (if variable phono gain is required). A muting circuit would be a worthwhile feature.

Suggested retail price of the Dynaco PAT-5 is $399 in kit form.

Further information on Dynaco products can be obtained from the Australian distributors, Harman Australia Pty Ltd, 271 Harbord Road, Brookvale, NSW 2100. (L.D.S.)

A new high-quality compact loudspeaker system

BUILD THE 3-53L PLAYMASTER

Here is a more compact build-it-yourself loudspeaker system for those on the lookout for something smaller than the Playmaster 3-75L described in the May issue. Using the same "tweeter" and the same "squawker" for the top and mid-range, it substitutes the Nisco 10-inch woofer for the bass end, but mounted in a 53-litre sealed enclosure.

by NEVILLE WILLIAMS

As with the 75-litre enclosure, a packaged cabinet kit will be marketed by Dick Smith Electronics, making it possible for almost anyone to assemble a pair of enclosures to commercial standards—without a workshop, without an elaborate tool kit and without any special skills.

More about that later.

As well, we have prepared a modified drawing which shows the dimensions of the enclosure and the way it goes together. Other distributors can produce their own versions of it or, if you fancy yourself as a cabinet maker, you can derive the dimensions which would be appropriate for "handyman" methods of assembly. In the latter case, you can veneer your enclosures, lacquer them, fit them with Queen Anne legs, or build them right into a wall or a storage unit!

Electrically, you can exercise one of three options:

- Interconnect the drivers directly with the crossover network intended to go with Nisco speakers, to get a bright sound, often favoured for pop. music.
- Spend a dollar or so on resistors to pad down the tweeter and squawker to give a more uniform response across the spectrum.
- Fit the Level Control pots as specified for the 3-75L. They will add a few dollars to the cost but will allow you to balance the sound to your liking.

Whichever option you choose, you will find that the sound has a clean quality but our own preference would be to fit the Level Controls, added expense notwithstanding. In these circumstances, the difference at likely domestic listening volume would not be all that great between the larger and the smaller system—a little less weight in the bass deep down, but otherwise very similar.

Above, a front view of the completed Playmaster 3-53L system, with grille removed. There is ample room for the Level Controls on either side of the tweeter, if these are fitted as a desirable "extra".

Sensitivity overall is very similar but whereas the larger system was rated at 80W maximum, 40W nominal, the limiting figures for the 10-inch woofer are 60W maximum and 30W nominal. Crossover frequencies remain the same at 1500Hz and 5000Hz and the nominal input impedance 8 ohms—free of the deep minima that can make things uncomfortable for some amplifiers.

We described, in the May issue, the circumstances which finally led us to the development of the Playmaster 3-75L system and now to the Playmaster 3-53L.

Briefly, the present situation in Australia is that locally produced drivers are in rather fitful supply and, while there are any number of imported units, and models left over from earlier production runs, we did not come across any that we could really count on as the basis for a long-term home construction project.

What did come out of our search, however, was a line of Japanese Nisco drivers which seemed to be well established and likely to remain available for the next couple of years, provided there was a continuing demand.

A 3-way system, involving tweeter, squawker and woofer, the Nisco package was available with a suitable—and relatively inexpensive—crossover network, and constant impedance high-range and mid-range level controls. While these items are currently being imported and distributed on a retail and wholesale basis by the Dick Smith organisation, we understand that they could be brought into Australia independently by any other company having the necessary resources.

We also understand that, for marketing reasons, the items will be branded with something other than the Nisco name.

As discussed in the May issue, the current fashion in the hifi loudspeaker market favours multiple drivers—a 3-way system at least—and the largest possible woofer.

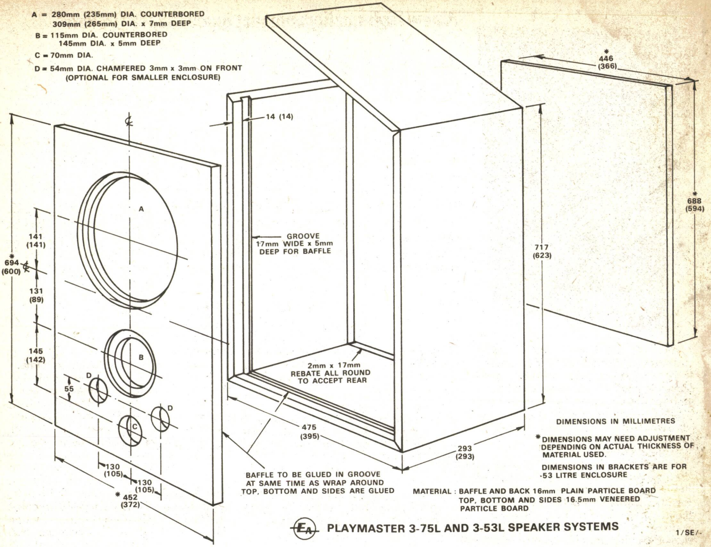
The "3-way" requirement is quite practical, requiring that the drivers be suitably fed and phased, and matched to each other in the matter of sensitivity. The "largest possible woofer" bit is quite another matter, in that it tends to become the "largest possible boomer", when mounted in a compact enclosure—also one of the dictates of current hifi fashion.

In the Playmaster 3-75L system we obliged with a 12-inch woofer but stipulated a 75 (approx.) litre enclosure to ensure that it would not disappoint those listeners who like to hear the big drums and the big pipes to advantage.

But, when it came to designing a more compact system, there was no way we wanted to cram a 12-inch woofer into a 50-plus litre box. Even the 10-inch Nisco woofer is a bit of a squeeze, in the acoustic sense, but it added up to an acceptable compromise: a system resonance at about 60Hz, fairly well damped, effective output down to 40Hz or better, and a power handling capability commensurate with 20W to 40W amplifiers used in the home.

You may have noted that we specifically said "sealed" enclosure. As we explained in the May issue, ported enclosures are fine provided the designer is free to choose and dictate the size and specification of the woofer. However, when one has to start with a woofer which may be larger than what he would normally choose, and with different specifications perhaps, it is simply easier to take the alternative course. And, because reasonably generous sealed enclosures are more tolerant of other

A = 280mm (235mm) DIA. COUNTERBORED
309mm (265mm) DIA. x 7mm DEEP
B = 115mm DIA. COUNTERBORED
145mm DIA. x 5mm DEEP
C = 70mm DIA.
D = 54mm DIA. CHAMFERED 3mm x 3mm ON FRONT
(OPTIONAL FOR SMALLER ENCLOSURE)



DIMENSIONS IN MILLIMETRES

*DIMENSIONS MAY NEED ADJUSTMENT DEPENDING ON ACTUAL THICKNESS OF MATERIAL USED.

DIMENSIONS IN BRACKETS ARE FOR 53 LITRE ENCLOSURE

MATERIAL : BAFFLE AND BACK 16mm PLAIN PARTICLE BOARD
TOP, BOTTOM AND SIDES 16.5mm VENEERED PARTICLE BOARD

EA PLAYMASTER 3-75L AND 3-53L SPEAKER SYSTEMS

1/SE/-

This composite diagram shows the dimensions of the Playmaster 3-75L system described last month and (in brackets) the equivalent dimensions for the smaller 3-53L system. It is shown upside-down as it would be during assembly. The holes for the Level Controls may not be needed in the 3-53L. Special note: To stiffen the 3-53L baffle, a timber cleat e.g. 18mm x 42mm x at least 250mm should be pinned and glued edge-on to the rear surface, horizontally between the woofer and squawker.

drivers, stockists can invest in locally produced woodwork without being quite so dependent on what happens in a factory on the other side of the World.

So then, if you want to build up a pair of Playmaster 3-53L loudspeaker systems, one obvious option is to buy the wherewithal from Dick Smith Electronics or from one of their associated distributors:

- A twin-pack of pre-cut, pre-finished woodwork for two enclosures.
- A carton containing six drivers, necessary for the two 3-way systems.
- Two crossover networks and wiring looms fitted with solderless connectors.
- Four 3.3-ohm 5W resistors and four 15-ohm 5W resistors if you wish to pad down the tweeters and squawkers, as suggested earlier.
- Two high-range and two mid-range constant impedance faders in lieu of the aforementioned resistors, if you wish to incorporate Level Controls as recommended.

The above items can all be obtained separately to assist those who, for example, may wish to build their own enclosures, or who may prefer other drivers in the same enclosures, or who simply need some of the components.

Other companies, not connected with the Dick Smith organisation can, we understand, obtain supply on a wholesale basis or make their own import and manufacturing arrangements.

Turning now to the enclosure as pictured, the sides, top and bottom are cut from one strip of presurfaced particle board. 90-degree grooves are milled where the joints will be, leaving the segments held together only by the imitation timber grained surface finish. An additional rectangular groove is milled to take the front baffle. When adhesive is run into the grooves, and the sides, top and bottom are folded around the baffle, a rigid, potentially airtight enclosure is formed.

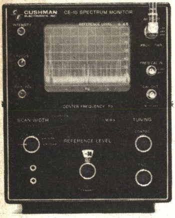
While the surfacing material provides a surprisingly effective "hinge", allowing the panels to be folded and unfolded, we suggest that you don't tempt fate by idly demonstrating to yourself or to anyone else how it all goes together. Leave that until you are ready to do the job.

Before starting, make sure that you have available a large tube of PVC adhesive ("Aquadhere" is fine), some adhesive tape, and clear space on the floor covered with paper, in case you spill some glue. Oh, yes, and a scrap of clean cloth to wipe off any surplus.

Open the cabinet timbers full length on the floor and tentatively stand the baffle, tweeter end down, in what will ultimately be the top of the enclosure. The idea is that, when the panels are folded around it, the join where the two outer ends ultimately meet will be at the bottom, resting out of sight on the carpet. Remember also that the rebated side of the baffle is the front face.

Having worked out how everything will fit together, put the baffle aside and apply adhesive to all the 45-degree surfaces and to all surfaces of the rectangular slot for the baffle. Apply enough

Cushman



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adhesive so that, when spread with a finger, it will wet all surfaces thoroughly and evenly. Wet the butt edges of the baffle all round and, for good measure run a thin extra line of glue in the bottom of each V and in the rectangular groove.

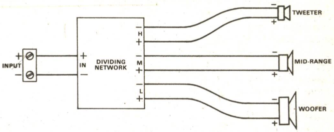
This done, slip the baffle into position, tweeter end down and rebated face to the front, without pushing it too hard into the groove. Now fold the sides and bottom carefully up around it, allowing the baffle to slip into its natural position, without straining either "hinge". Bump the panels into place with the ball of the hand, bringing the two free edges tightly together. Hold them in this position with as many strips of adhesive tape as seem necessary.

Wipe away the surplus adhesive which will have been squeezed from the joints and put the enclosure aside overnight for the joints to set hard. The second enclosure can be assembled in a similar manner.

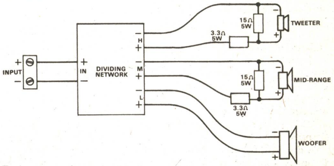
If you want to be doubly fussy, prop the two enclosures so that they are resting on the edge that you have to hold closed. Run a line of glue on the inside of the join, bridging the side and bottom.

The next logical operation is to mount the loudspeakers. It isn't a difficult task but be careful how you handle the speakers and the tools, otherwise you may end up with a finger or a screwdriver through a cone.

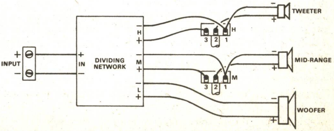
You will need sixteen 8-gauge by 19mm self-tapping screws to mount the woofers and squawkers, about sixteen 6-gauge by 16mm self-tapping screws to mount the tweeters and crossover networks and the same number of smaller countersunk head woodscrews for the level controls, if fitted.



Connecting the drivers directly to the divider network as shown gives a clean sound but over-bright for most program material.



To improve the overall balance of the system, the output level from the tweeter and squawker can be reduced by means of resistors as shown.



The option we recommend is to purchase and instal Level Controls for the tweeter and squawker.

It is essential to drill pilot holes for the 8-gauge screws, marginally smaller than the core of the thread to minimise the risk of splitting the particle board. Angle the holes very slightly away from the cutout edge for the same reason.

There is a temptation just to put the cabinet on its back, drop the speakers in place and drill through the holes. If you do, you'll probably end up with chips clinging to the sticky cone surround, compromising the appearance of your woofer for ever after. Lay the speakers in position—they should drop neatly into the rebate—mark the holes with a pencil and remove the speakers before drilling. Make sure, for the sake of appearance, that the holes are symmetrical in relation to the baffle centre line.

There remains the problem of how particular one should be about sealing around the drivers and level controls.

With precision woodwork, everything should seal reasonably well if just screwed into position but there is the risk of spoiling the ship for the traditional half-penny worth of tar.

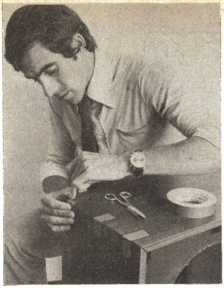
Three possibilities come to mind, all of which we have seen used.

The simplest is to screw the woofer and squawker into place with the cabinet on its back, then to run a thin line of the PVC adhesive in the space between the rebate and the edge of the housing. For the tweeter and controls, smear the surfaces which will mate with adhesive, screw them in place and leave to set. The adhesive will seal fine but, if you ever have to remove any of the items, you will have to break the glue seal and you will leave behind a rough surface—ridges of hard glue and holes where the glue has pulled out the particle board fibres.

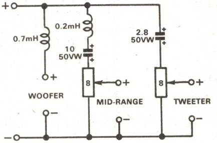
Another possibility is to roll non-hardening caulking compound into the string, as uniform as you can manage, and to tuck it into the corner of the rebates and around the edge of the cutouts for the tweeter and controls. Tighten them down against the caulking and pare off any surplus that squeezes out, using your screwdriver blade like a putty knife. The art in using caulking compound is to apply it evenly so that it spreads uniformly under pressure—not a lump here and nothing at all somewhere else!

A third possibility, which we prefer, is to apply a gasket to the supporting face of the rebate, using a strip either of adhesive-backed felt or adhesive backed foam (e.g. Engel's no. 5C draught excluder, sold by hardware stores). Use this also to back the tweeter. The controls can be sealed in the same way or with caulking compound pushed in from behind. Incidentally, poke holes through the foam before attempting to drive the screws.

Another important point: tighten the screws into the particle board just to the point where they "nip". Apply more pressure than that and you stand to strip the hole.



Both these pictures were taken with the prototype 3-75L enclosure but the 3-53L goes together in exactly the same way.



Circuit details of the cross-over network. Note that the level controls are constant impedance pads, not ordinary potentiometers. System impedance does not fall below 7 approx. ohms at any setting.

Now move to the rear of the cabinet and install the wiring. If working with a prepared harness, it will involve only pushing clips on to the appropriate tags. Otherwise, you may have to cut your own leads and use soldered joints. Either way, make absolutely sure that you identify the "plus" leads on all drivers (stamped "+", red paint spot or red washer) and effect the ultimate connections as shown in the appropriate wiring diagram, including that to the external tagstrip.

If not already marked, designate the plus connector on the outside of the enclosure, so that both loudspeaker systems can be connected symmetrically to the amplifier.

The filter network can be mounted anywhere that is convenient and within the reach of the wiring loom but remember that, wherever you put it, the wiring will have to dodge around the acoustic packing. We ended up screwing the network on the bottom of the enclosure beneath the woofer, extending the leads from the input connector underneath the Innerbond filling.

For the Innerbond (or equivalent bonded fibre acoustic material), we suggest you cut a strip 3 metres long by 60cm wide and roll the two ends like a scroll, so that it will be self-supporting.

This done, the back can be inserted and glued in position—a rather final act because, thereafter, any access to the enclosure will have to be gained through the loudspeaker holes. It would, of course, be possible to add internal cleats and screw the back down against a felt or foam gasket, but this should be quite unnecessary. The chances are that you'll never need to get inside the enclosure again.

Assuming that you follow the intended course, lay the enclosure face down and wet the entire rebated surface with PVC adhesive, without leaving any surplus behind. Also wet the edges of the rear panel and press it into position. For good measure run a thin line of adhesive around the space between the two, leaving the enclosure face down until the adhesive has hardened.

Finally, stand your enclosure the right way up, wipe off any signs of your toil, press the foam grille into place and the job is done.

FOOTNOTE: While we did no original work on the crossover network, home-made inductors could be based on those mentioned in our June 1976 issue. For the larger inductor, make up a non-metallic bobbin with a 25mm dia centre and 50mm cheeks 20mm apart. Wind on 165 turns of 18B&S or 19SWG for an inductance of about 0.7mH. The 0.2mH inductor can have 90 turns on a similar bobbin. Alternatively, the latter can be wound on a moulded bobbin (RCS Radio) originally intended to slide on to a ¾ X ¾in core and measuring 1-7/16 across the faces. Wind on 105 turns of the wire specified.

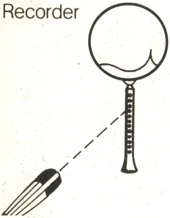
MICROPHONES

Part 9: Solo instruments and the orchestra

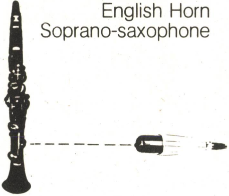
Reproduced by courtesy of Sennheiser Electronics, this series of articles is intended to assist sub-professionals and amateurs who need to use microphones, but without the advantage of formal acoustic training. This article, the final in the series, discusses the optimum microphone placement for a wide range of individual instruments. Presented in diagrammatic form, with a minimum of text, it should prove an invaluable compact reference which, if necessary, can be taken into the field.

by G. PRAETZEL and E. F. WARNKE*

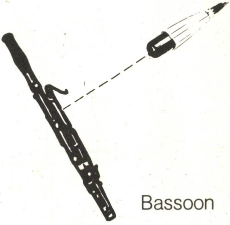
Translated by T. M. Jaskolski and adapted for magazine publication by P. G. Watson.



Recorder



Clarinet, Oboe
English Horn
Soprano-saxophone



Bassoon

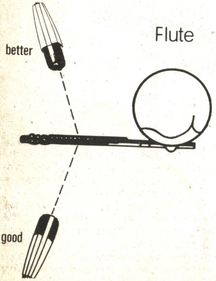
This page shows a typical group of "woodwind" instruments (not all are made of wood) with suggested microphone placements for best recordings. One condition to be avoided is to place the microphone so close to the instrument that wind, breathing, or keying sounds become unduly prominent.

On the other hand, too great a distance and/or an incorrect angle to the instrument can cause loss of high frequencies, particularly where the instrument tends to radiate these as a beam.

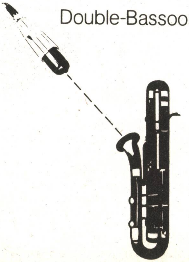
For the flute, recorder, bassoon, clarinet, oboe, English horn, soprano-sax, etc, a directional microphone should be aimed at the centre of the instrument in order to ensure a good balance over the full range of notes. In the case of the flute, better protection against unwanted sounds results from placing the microphone behind the player.

The saxophone—other than the soprano saxophone—the bass clarinet and the double bassoon are fitted with an amplifying bell-mouth which produces marked beaming of the high frequencies. For this reason the microphone should face directly into the mouth of the instrument.

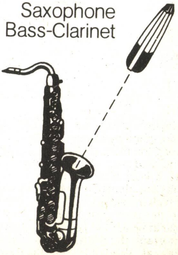
As with the descriptions to follow, these set-ups are only suggestions. It may often be necessary to experiment, by making trial recordings, in order to obtain the best result. These suggestions provide a starting point which should avoid the worst errors, but which may be varied to suit the acoustic environment.



Flute

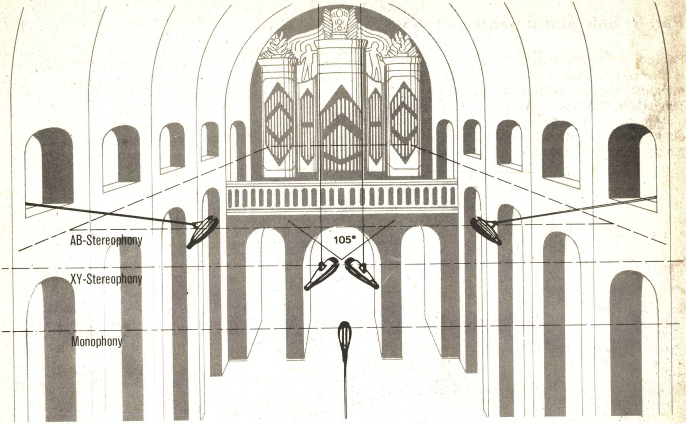


Double-Bassoon

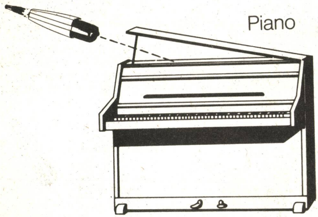


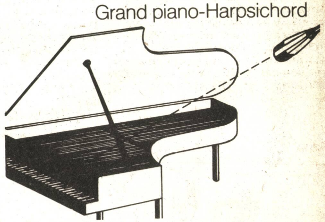
Saxophone
Bass-Clarinet

MICROPHONES



In recording a pipe organ a major requirement is to avoid recording the various mechanical noises created by the blower, valves and similar mechanisms. These are best avoided by placing the microphones at a sufficient height, usually at the level of the smaller central pipes. For stereo either AB or XY systems may be used, the latter being preferred when choirs or soloists are also involved. The microphones may be supported on long stands from the floor, extended from the side galleries, or suspended from the roof.





Keyboard instruments, such as the piano, grand piano, and harpsichord, are among the more difficult to record. The piano, and particularly the grand piano, have a wide dynamic range as well as exhibiting directional characteristics in the higher frequencies.

In the case of the upright piano the angle at which the lid can be opened is important, the preferred arrangement being as shown in the diagram. In general, the directional axis of the microphone should be aimed at the more distant strings in order to preserve a good balance.

Directional microphones are usually necessary to cope with the room acoustics, but a suitable amount of reverberation can often enhance the sound of a piano. There is plenty of room for experiment here.

When the piano is part of a jazz group it is usually treated as part of the rhythm section. It is best given its own microphone located as close as possible to the preferred octave strings. This will preserve the rhythm but at the expense of the piano's characteristic sound.

The harpsichord does not have the dynamic range of the piano and in this respect lends itself to closer microphone spacing. On the other hand, it tends to be more noisy mechanically and such noises may be emphasised by working too close.

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TT801	1.20
2N301	2N2869
2N706A	1.20
2N918	1.60
2N2222A	1.20
2N2646	2.50
2N2869	2.70
2N2904A	1.50
2N2905	1.20
2N3053	1.20
2N3054	1.70
2N3055	1.35
2N3564	.65
2N3565	.55
2N3566	.95
2N3568	.95
2N3569	.50
2N3638	.55
2N3638A	.60
2N3642	.55
2N3643	.55
2N3694	.65
2N3731	5.95
2N3819	1.35
2N3866	2.75
2N4037	1.25
2N4249	.65
2N4250	.65
2N4355	.65
2N4356	.65
2N4360	.95
2N5245	.75
2N5457	MPF103
2N5458	MPF104
2N5459	MPF105
2N5485	MPF106
2N5590	MRF603
2N5591	11.30
2N6027	1.35
2N6084	21.00
2SC799	5.50
2SC1306	5.50
2SC1307	5.50
BA102	.80
OA47	.60
OA90	.35
OA91	.35
5082-2800	3.20
40440	2N3731
40637A	2.85
40673	1.95
40822	2.90
40841	1.90
BZX61	.75
BZX79	42
BZX70	1.50
BZY93	2.60
BZY91	12.50
PA40	5.85
PB60	6.50
MEL12	1.40
FCD820	1.90

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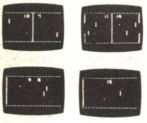

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ETI 804 KIT	$52-50
COLOUR KIT	$84-50
COLOUR PROCESSOR KIT	$36-50
RIFLE KIT	$25-00
FULLY ASSEMBLED B & W	$66-50
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for full details

Manufactured units include AC Battery Adaptor . . . not included in kits.

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SPECIFICATIONS

Receiver

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Sensitivity .... 0.7 V for 10dB S/N to N ratio
Selectivity .... —6dB down at 6KHz, 50dB down at 20KHz
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Audio Output .... 3 watts into ext. speaker jack: 8 ohms
Auxiliary Circuits .... Switchable noise limiter, Variable squelch, PA, S/P-RF meter

Transmitter

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Harmonics Suppression .... Exceeds FCC requirements —50dB or better.
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MICROPHONES

Brass wind instruments consist of three parts: mouthpiece, instrument pipe, and sound bell. The mouthpiece gives the instruments their characteristic sound. It consists of a cup or funnel shaped hollow cavity in which the player's lips put in vibration the air column connected to the mouthpiece.

The trumpet, bugle, trombone, valve trombone, etc, are best recorded by directing the microphone straight at the bell of the instrument. Exceptions are the French horn and the bass tuba. The French horn is best handled by picking up the reflected sound from a flat surface. For the bass tuba the microphone should be at an angle to the bell mouth.

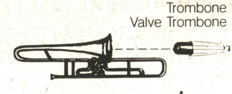
One reason for these latter precautions is the much larger bell mouth fitted to French horn, bass tuba, etc. These tend to emphasise handling and other unwanted noises.

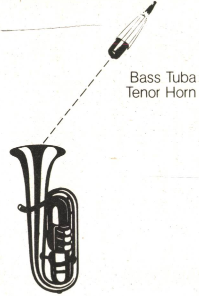
Bowed string instruments, such as the violin, viola, violincello, double-bass, etc, should have the microphone directed at the "f" shaped holes in the sound board, and at a slight angle to it. The latter suggestion is to minimise fingering noises.

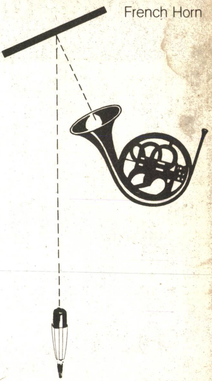
Microphone distance from the double bass may vary with circumstances. When used in a jazz or dance group it may be necessary to provide a microphone very close to the instrument, due to its low output. It may also be necessary to shield this microphone from the sound of the other instruments.

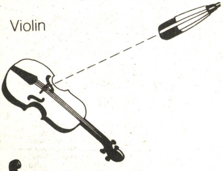
Plucked string instruments include the guitar, banjo, mandolin, lute, harp, etc. With the exception of the harp, these can be treated in much the same manner as the bowed string instruments. There may be some advantage in directing the microphone slightly lower on the sound board if the plucking sounds are too obvious.

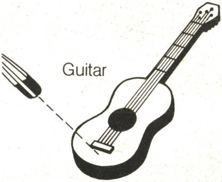
The harp needs special attention due to its wide tonal and dynamic range. The best microphone position appears to be behind the player, directed at the strings over the player's right arm. This applies to the playing position, with the instrument tilted towards the player. Check that the pedal action does not create noise.

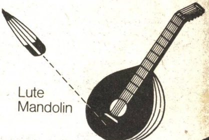


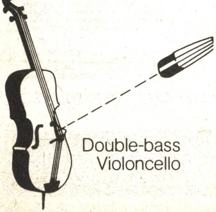


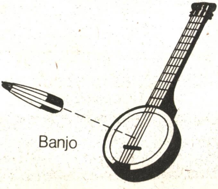


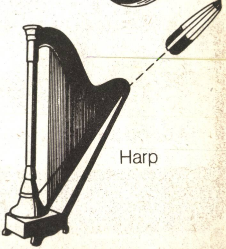












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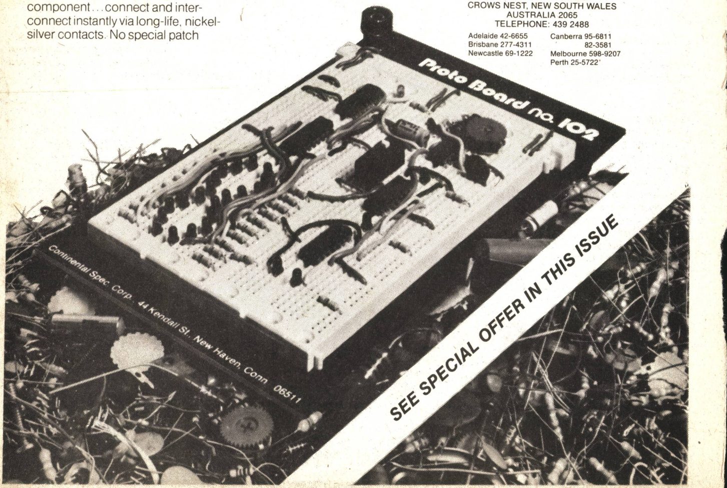
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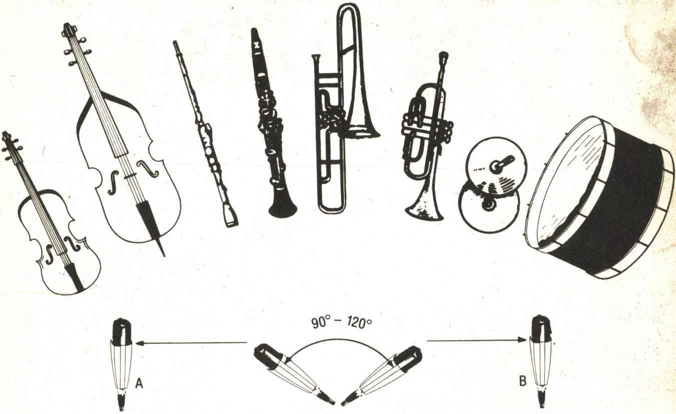
SEE SPECIAL OFFER IN THIS ISSUE

MICROPHONES



A small orchestra may be recorded in stereo using either the A-B or X-Y technique. A-B microphones are spaced 3 to 5 metres apart. As with the choir (Part 8) height is used to keep the instrument/microphone distance within 1.4 to 1. The triangle, flute, xylophone, oboe, etc, should be kept within 30° of the axis of at least one microphone. If test recordings reveal severe unbalance, individual instruments may be moved closer to or further from the microphones.

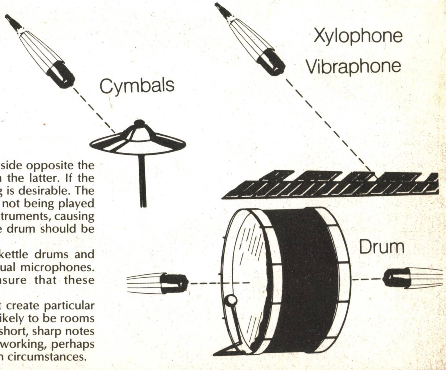
There are two types of percussion instruments; the drums, using a membrane stretched over a metal frame, and the solid body, self-sounding types such as the cymbal, triangle, gong, xylophone, etc.

Drums used in jazz or dance bands—bass drum, tenor drum, bell drum, tom-tom, etc—are best recorded by assigning them an individual microphone in close proximity. This preserves the compact, precise sound of the drum.

The bass drum is best recorded from the side opposite the pedal, to minimise mechanical noises from the latter. If the pedal side must be used, very close spacing is desirable. The snare drum presents a problem. When it is not being played it can respond to loud sounds from other instruments, causing the strings to rattle. During idle periods the drum should be damped or the microphone faded out.

When recording orchestral groups the kettle drums and large drums are not normally given individual microphones. On the contrary, it is necessary to ensure that these instruments are not recorded too loudly.

Triangles, gongs, xylophones, etc, do not create particular recording difficulties. The main problem is likely to be rooms with long reverberation times, in which the short, sharp notes are likely to create confused sound. Close working, perhaps with reduced playing volume, is best in such circumstances.



CB

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THE 27MHz SCENE

CB-STYLE GEAR FROM PETER SHALLEY COMMUNICATIONS

Peter Shalley Communications is well known in the 27MHz business, having been suppliers to Government utilities and other users, long before the present flush of amateur and CB interest in the 27MHz band. We look here at a few of the items which they are currently offering for sale.

by NEVILLE WILLIAMS

Headquarters of the Company is at 554 Pacific Highway, Killara, NSW 2071, and their telephone number is (02) 498 2611. While they have majored to date on direct retail sales and mail order, they are keen to establish a relationship with dealers in all states who may wish to market their products as advertised.

Strongly recommended by Peter Shalley is the Tokai model TC-1001, as pictured—a 23-channel transceiver capable of working either on AM or on upper or lower sideband.

The TC-1001 is a compact unit, measuring approximately 165 mm wide, 60 mm high and 223 mm deep, excluding controls and connections. For installation in a vehicle, it would normally hang beneath the dash and a suitable cradle is provided as a standard item. Since microphone, power and antenna are all plug connections, the equipment could be disconnected very easily, as required.

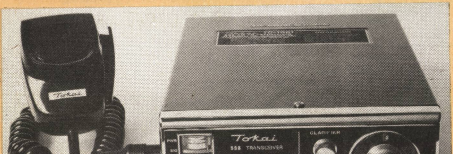
A brochure which comes with the TC-1001 draws attention to a number of supplementary units which may well increase its appeal to individual users. One such is a matching combination mains power supply and inbuilt speaker which can transform the TC-1001 into a base station. The auxiliary unit rests on the table and supports the transceiver on top, using the cradle screws and sockets.

Another interesting item is an attachable VOX unit providing automatic break-in operation in lieu of the manual press-to-talk facility on the microphone. In fact, a headset is also listed, combining a microphone and earphone, and giving completely personalised VOX operation.

Last but not least is a combined handle and battery pack which can be fitted to the TC-1001, converting it to a portable set, with a mounting provision for a suitable whip antenna.

The Tokai TC-1001 offers all the usual facilities for this type of equipment: an illuminated rotary selector provides for 23 channels, with an "E" position for "external" or public address output, the latter requiring an external loudspeaker. A "clarifier" control modifies the crystal-locked channel frequencies sufficiently to "net" with incoming transmissions and simultaneously adjusts the transmitter. The mode—LSB, USB, AM and PA—is selected by an adjacent switch.

The other half of the panel contains a slide volume control, a slide squelch control, a slide type off-on switch and another for "NB"—noise blanker. At the top left-hand corner is a small edgewise meter indicating RF output power and incoming signal level.

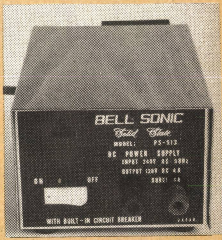


The Tokai AM/SSB transceiver model TC-1001 is more compact than most comparable units and is readily adaptable to multiple roles: vehicular or marine mobile, mains powered base station or battery-powered portable—the latter involving a special cradle and whip antenna. The receiver noise blanker facility is valuable in the presence of impulse interference.

Electrically, all the controls work smoothly but the user does pay a price for the number of facilities and the small frontal size of the TC-1001. A firm grip is necessary to rotate the channel selector, while an even firmer grip is required for the small "Mode" knob. And the meter must be one of the smallest in the business.

Bold printing on the carton tends to take one aback at first glance: 46 channel, 25W SSB, 5W AM.

In fact, the "46" is arrived at by regarding the upper and lower side bands as separate channels—legitimate where, as here, the receiver has adequate selectivity to separate them. And the power figures are "input"; one would logically assume that the RF power normally available at the antenna output socket would conform to the normal US class-D practice of 12W PEP on SSB and 4W AM.



The Bell Sonic solid state power supply available from Peter Shalley Communications. This sample unit had a slight lamination hum but was electrically noise and hum-free. Note that the current rating is 4A, leaving a generous margin for auxiliary equipment.

Other specifications of the transmitter are normal for 23-channel CB gear, apart from the frequency tolerance which is notably tight at 0.0015%.

The receiver is a triple conversion design with crystal lattice and ceramic filters to ensure an order of selectivity and image rejection which is well up with accepted standards of performance.

Tested on air from a fixed location,

reports from other amateur stations verified the signal as good and clean, with effective modulation on both AM and SSB.

The receiver performance was well up to standard, judged on both very strong local carriers (a test for the AGC) and on weak DX signals during one of the periodic break-throughs on the 27MHz band. In the latter role, the noise blanking facility showed its ability to cope with pulse type interference.

Recommended retail price for the Tokai TC-1001 is $289.00—a fully competitive figure for this class of equipment.

At the other hand of the scale from the Tokai TC-1101 is the tiny Contact-5W transceiver also pictured here.

Whereas the TC-1001 is a full 23-channel AM and SSB unit, with all the usual trimmings, the Contact-5W provides for AM only, on six possible channels, with just three panel controls, plus a "transmit" indicator button and tiny meter to indicate battery voltage, received signal strength and RF output power.

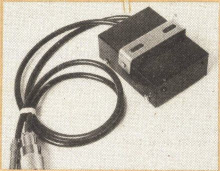
Physically, the case of the transceiver is really small, approximating 150 mm x 38 mm x 130 mm deep, so that it should be able to rest, or hang, in spaces far too small for most other units. Yet, with an input rating of 5W, it should give a good account of itself when coupled into an efficient 50-ohm resonant antenna.

While the Contact-5W could ostensibly be used as a 6-channel unit on the normal 27MHz CB channels, it is not envisaged in this role by Peter Shalley Communications. It is offered rather as a type approved transceiver for mobile marine purposes and fitted with one pair of crystals for the 27.88MHz channel. Alternatively, it can be supplied to Bushfire brigades or other specifically licenced users, with appropriate pairs of crystals fitted.

The fact that it has been produced by the manufacturer to ensure Australian type approval, is reflected in the cost of the unit: $127.00 including one set of crystals.

Physically, there are positions for five other sets of crystals, but these would cost about $9.50 per pair. For casual amateur or CB use, therefore, the Contact-5W would not be competitive with normal 23-channel AM transceivers. Its strong appeal is in its small size and the fact that it is type approved for specified-channel operation by licenced services and utilities.

The Contact 5W above is a really small transceiver, for AM only, with 6 possible channels but normally supplied with a single set of crystals. However, it is a type approved unit intended primarily for mobile marine use.



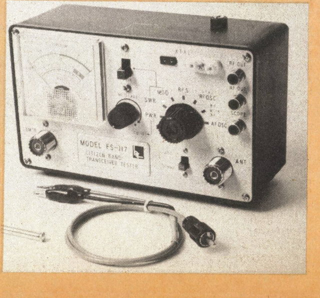
Where a driver is unwilling to fit a proper resonant antenna to his vehicle, Peter Shalley suggests using this little adaptor which allows a 27MHz transceiver to share the ordinary car radio antenna.

For those who have already on hand an adequate 27MHz transceiver, but who may wish to operate it as a home station, Peter Shalley offers the Bell Sonic power supply unit, rated to deliver 13.8V at up to 4A, with a surge rating of 6A, and an in-built circuit breaker to protect it against overloads beyond that again. As such, it should be more than adequate to power any likely CB transceiver, plus auxiliary items such as an RF preamplifier.

Little more need be said about the supply than that we used it for a period with a typical transceiver, without hum, interference or other incident. List price of the Bell Sonic PS-513 supply is $49.95.

Another item in the Shalley box of tricks is a small adaptor unit which makes possible interconnection of a 27MHz transceiver and an ordinary broadcast band receiver with a common radio aerial, as fitted to most cars. The adaptor measures 58 x 30 x 80 mm deep and should present no problems in fitting. One lead, terminated with an SO-239 plug connects to the transceiver, another connects to the broadcast receiver, while a socket accepts the usual broadcast antenna plug.

Without attempting to dismantle the adaptor, it would appear to rely on resonant traps to isolate the two receivers and, in particular, to keep the



With an obvious attraction for performance orientated operators, this Hansen FS-117 CB tranceiver tester can measure power output, standing wave ratio, modulation level, plus relative field strength and crystal test facilities.

THE 27MHz SCENE

energy from the 27MHz transmitter out of the broadcast receiver front end. A LED coupled to the 27MHz trap glows when the transmitter is energised and, according to the published advertisements allows some assessment to be made of the SWR.

What the SWR would be, and how efficient the pickup and radiation from the car antenna would depend on its length and condition, its position on the car, and the characteristics of the feed cable. With luck, the SWR might be low and the radiation efficiency high; with less luck, the reverse might be the case!

All these factors would, of course, vary from vehicle to vehicle, added to which the adaptor might be variously appropriate with different types of transceiver and with different types of broadcast receiver. Any test on any individual vehicle would therefore not be representative and we can only accept the supplier's assurance that it meets a real need.

With all the appearance of a handmade unit, the antenna adaptor is a rather unpretentious piece of equipment and the price tag of $35 seems a lot to have to pay for it. But, as the advert says, if you want to use 27MHz equipment in a car without the "tell-tale CB aerial", you may consider its purchase worthwhile.

Last but not least, for those who want to keep a check on the operation of their equipment, as distinct from merely using it, Peter Shalley offers the Hansen FS-117 Citizen Band Transceiver Tester. By providing a modulation measurement plus crystal signal and test facilities, it goes a couple of steps beyond the more usual SWR, power and monitor instrument.

Like an ordinary SWR and power meter, the FS-117 has a pair of SO-239 sockets for connection to transceiver and antenna, but with a built-in load resistor selectable by a panel switch. This is at the one time a convenience and a limitation: convenient because it obviates the need for an external resistor bank; a limitation because the internal load and meter provides but a single 5W power scale—sufficient for class-D CB transceivers but little beyond that.

The SWR meter operates in the usual fashion, with direct readings to 3, while the relative field strength also follows usual practice with a small telescopic antenna and an internal diode to rectify the RF and feed it to the 100uA meter. The rectified output is available at a pinjack marked "Scope" and would allow the modulated envelope to be examined where the additional instrumentation was to hand.

Additional facilites offered by the FS-117 include a modulation percentage test with a meter readout calibrated to 100%. Like all the other scales on the meter face, it is clearly marked and very easy to read.

The remaining three test positions on the function switch invoke in-built oscillator circuits powered by a 9V battery.

In the first position, a transistor operates in a Pierce configuration with a crystal plugged into either of two sockets. The facility can be used to test crystals for activity, but it can also be used to provide an unmodulated crystal-locked signal on a CB channel.

In the next switch position an audio oscillator is brought into circuit to provide the same signal modulated.

The final position makes the audio tone available alone, as a possible audio source for the transceiver modulator.

The FS-117 is supplied in a typical Hansen carton with a small sheet of instructions and circuit diagram. Recommended retail price is $54.95.

From Tandy:
Anyone who does any experimenting at all with 27MHz equipment soon discovers the need for cable connectors of one type or another—usually and exasperatingly the one that isn't to hand! Pictured above are two of the many connectors which are currently stocked by Tandy Electronics Stores. By supplementing these with others made up by hand from oddments, and a few coaxial patch cords, experimeters can often save themselves a lot of frustration.

ROYCE: A note on RF power meters

A supplementary sheet, packaged with the Royce I-662 transceiver, reviewed last month, explains the basis of the power output meter. It makes interesting reading for those who may not have considered the factors on which the readings of such a meter depend, when monitoring the signal being fed to an actual antenna.

While referred to as a power meter, it is really measuring the RF voltage across the coaxial output socket. If the reading is distinctly below expectations, say one-third deflection instead of two-thirds, it is likely that there is something amiss in the transceiver, such that it is not delivering proper drive to the antenna circuit. Either that, or there may be an external factor severely reducing the impedance of the apparent load.

If, on the other hand, the meter reads beyond normal deflection, up into the red area, it does not mean a higher than expected power output. The meter is really reading a high RF voltage across the output connector and this is most likely to be due to the load being well above the expected impedance of 50 ohms. If the antenna is trimmed to 50 ohms resistive with the aid of an SWR meter, the transceiver power output meter should drop back to a normal reading.

Royce point out, in fact, that the power output meter can be used to trim an antenna to resonance in the absence of an SWR meter. The idea is to adjust the antenna resonance, by whatever means is provided, until the RF output reading passes through a discernable dip, say on channel 12. By tuning for the dip—the LOWEST reading—the antenna should be absorbing maximum power from the transmitter and, if all is well, the dip should correspond to the top of the black scale and a power output approximating 4W.

The same general remarks would apply to similar external power meters, when looking into an antenna, as distinct from a 50-ohm resistor. An optimistic reading does not mean more power into the antenna but simply higher volts across an improperly loaded output circuit.

TYPE APPROVAL FOR AMATEUR EQUIPMENT?

According to a recent report, the American FCC is considering a proposal that all future amateur band transmitters and amplifiers must be type approved and that external RF amplifiers for the 24-35MHz range be banned from sale. Amateurs are bitter because the measure is aimed, not against them but against CBers who illegally buy and use amateur style equipment, without amateur style responsibility for it. In so doing, they cause interference with other services and other CBers.

Keep your signals clean—

Build this simple low-pass filter

How can an amateur be sure that his transmissions are not causing interference to neighbouring TV sets? To simply assume that they aren't because no one complains is a risky philosophy. By the time someone gets steamed up enough to protest, a lot of badwill and unfavourable comments will have resulted. The filter described should at least help the amateur to get in first and to minimise such situations.

by PHILIP WATSON

No amateur likes to think that his hobby is likely to be causing interference to other equipment—including his own TV set. (Amateur radio can strain domestic relations enough in other ways, without gumming up the XYL's soap opera!)

Yet the truth is that anything radiated from the transmitting aerial, including spurious radiation from the receiver, is a potential source of TVI if it lands in any of the TV channels, on a superhet "image" of a channel, or directly into an IF channel.

This applies to transmission on any amateur band from 1.8MHz right through to VHF. Granted, spurii from the lower frequency bands are likely to be fairly weak by the time they reach the TV frequencies. On the other hand, equipment running at 400W PEP, with an aerial only a few feet from a TV aerial, does not need to generate a very large percentage of harmonic or spurious output to run the risk of creating interference.

At higher frequencies, such as 27 and 28MHz, the risk is generally greater, even when low power is employed, since lower order harmonics are involved.

Nor is the problem necessarily confined to harmonics which land within a TV channel, as we have already indicated. There are almost unlimited possibilities for beats, mixes, "a plus b" effects, etc, involving either the direct signal, the IF system, and/or combinations of these.

All of which adds up to the fact that, for peace of mind, we need to know that any spurii we generate, and which are anywhere near the TV bands, will be well and truly suppressed before they can be radiated.

A popular way of doing this is to fit a low pass filter in the antenna feeder, designed to severely attenuate any signals above, say 30MHz or so, but without seriously affecting the signals we wish to transmit or receive.

Such filters are available commercially, while design data for them can be found in most amateur radio handbooks. Unfortunately, commercial units have been in rather short supply in recent months, creating a need for the amateur to "roll his own".

The snag is that, even with the availability of suitable data, there is still a fair amount of work involved in converting this to a working unit, compatible with components and hardware available on the local market. As a result, there is a tendency to "duck shove" the project until someone complains.

It was against this background that we came across mention of just such a filter in the September 1976 issue of the New Zealand publication "Break-In", the official journal of the New Zealand Association of Radio Transmitters. Here was a design already worked out, both electrically and mechanically, and which might well suit the Australian scene.

Called the "Newton" filter, it was being sponsored by the NZART South Canterbury Branch as either a kit of parts or fully assembled. Its construction was not described in the issue, information being confined to performance figures and a graph.

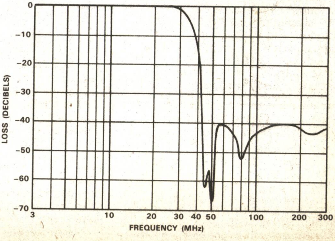
Two possibilities occurred to us: that this branch might like to expand their sales area to Australia, thus helping to fill the temporary gap in local supplies, or that they might care to make the information available for publication.

As it transpired, the Branch felt that they would probably be unable to cope with a sudden expansion of the market, although they would be willing to supply Australian buyers while their (limited) stocks last.

(New Zealand Association of Radio Transmitters, South Canterbury Branch, P.O. Box 73, Timaru, New Zealand. Kit: $NZ 8.50. Built up: $NZ 11.00. Plus postage for overseas buyers. The weight of the complete filter is 287g (approx.).

But they were quite happy to supply us with a sample unit and all instructions for publication. All we had to do was make sure that the hardware was readily available on the Australian market.

The performance figures and graph tell



This response graph was published in "Break-In" and redrawn by our own draughtsman. It conveys a more effective impression of the filter's behaviour than do the figures in the table.

SPECIFICATIONS

POWER HANDLING

350W at 10 metres
600 W at 15 metres
1kW at 20 metres
Better than 1kW at 40, 80, 160 metres.
These ratings are for an SWR less than 2:1. Ratings will be reduced at higher SWR.

INSERTION LOSS

0 to 30MHz, less than 0.5dB
Maximum insertion loss, 0.5dB at 22MHz
80 metres, 0.2dB
40 metres, 0.2dB
20 metres, 0.3dB
15 metres, 0.4dB
11 metres, 0.3dB
10 metres, 0.4dB

RESPONSE

Cut-off frequency (—3dB), 35MHz ±1MHz
35MHz, —3dB
40MHz, —15dB
44 to 300MHz, better than —40dB
45 to 50MHz, better than —60dB
These figures are for an SWR less than 1.5:1

LINE IMPEDANCE

From 50 to 75 ohms unbalanced.

their own story in detail. All we need say in general terms is that the response rolls sharply in the region of 35MHz, dips to around −60dB in the 45 to 50MHz region, then reverts to the −40dB level and is never worse than this up to 300MHz. There would be little in the way of spurii which would get past such a filter into the TV bands.

The components required are few and simple. The filter proper consists of four coils and three capacitors and the configuration is housed in a metal box, fitted with two cable connectors. Three stand-off insulators and a few minor items of hardware complete the list.

The box is worthy of particular mention. It is obviously an electrical junction box, and a very nicely made and finished one at that. Both the box and lid are of pressed metal, with four "knock-out" holes, one at each end and one on each side. The two end ones are used in this project.

It is approximately 100 mm long, 55 mm wide, and 58 mm deep, including the lid. Finish is in a durable grey coating, similar to Hammertone.

Unfortunately, this box would be unlikely to be available in Australia in the ordinary way, and standard boxes available are rather larger than necessary. Nevertheless, they could be used if nothing better is available. Alternatively, it would not be too difficult an undertaking to fabricate a suitable box from, say, tinplate, to the dimensions already given.

However, we were so impressed by the possibilities of this little box, for the hobbyist in general, that we approached Davred Electronics Pty Ltd with the suggestion that they organise to obtain these from their parent company in New Zealand. We hope that, by the time this appears in print, they will be readily available.

Unfortunately, the cost of this box will be somewhat higher than that of the larger boxes already mentioned. On the other hand, its small size and convenient "knock out" holes make it an attractive proposition.

The alternative style of box, already mentioned, is approximately the same length and depth (100mm × 50mm) but is about 80mm wide. It is made from two "U" shaped pieces of sheet metal which interlock and are held together with self-tapping screws.

Although cheaper, it has a couple of disadvantages. It is wider than necessary, making it less attractive in appearance than the junction box. Also, if it is to be fitted with Amphenol type sockets it will be necessary to cut a large hole at each end; a rather tedious process unless one has access to a ⅝in or 16mm punch.

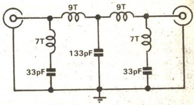
Also, the stand-off insulators will have to be mounted on the bottom of this box, which will probably mean that feet will have to be fitted also.

Boxes of this approximate size are available in several brands and from several of the larger supply houses. Davred Electronics, who will be stocking the junction box, also stock this style, known as the Davred No. 2 box.

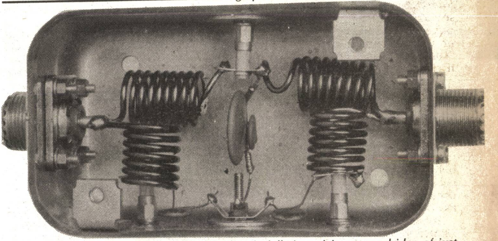
The connecting sockets at each end of the box may be selected according to the type already in use on the transmitter. The instructions suggest three possible types; the Belling-Lee type, the BCN, or the Amphenol SO239. We used the latter in our version, since this appears to be the most popular with transceiver manufacturers.

Incidentally, it is a pity that there is not some easy way to fit a female connector at one end and a male at the other, since this would allow such units to be connected directly into an existing system. As it is, it is necessary to make up a patch cord with a male connector at each end.

The accompanying photograph gives a good idea of the layout. Logically, the two connectors, the three stand-off insulators, and the chassis terminal point should be assembled first. One of the stand-offs can use an existing hole in the box, but an extra washer may be needed, since it is rather large.



The circuit is quite elementary and can be compared directly with the photograph below.



This inside view of the finished filter is exactly full size, giving a good idea of just how compact it is in the original box. The 133pF capacitor (two units) is vertical in the centre and the two 33pF units are at the bottom.

COIL DATA

2 coils of 7 turns, spaced to ⅝in (16mm) long
2 coils of 9 turns, spaced to ⅞in (22mm) long
All coils wound on 7/16in (11mm) dia. mandrel
All coils wound from 16g SWG, 14g B&S, or 1.6mm enamelled wire.

The coils should be wound according to the data in the accompanying table, and should be made as accurately as possible. Leave a reasonable length of wire on each to facilitate mounting without distorting the coil.

And that is about all there is to the construction. Having assembled it according to the instructions it should work without the need for any adjustment. In fact, the average reader will probably find that his test equipment is not up to making a complete test of a device of this kind, although it may be possible to make spot checks to confirm the general behaviour.

Easy-to-build unit covers 10-30MHz

Tunable RF Preamplifier

This tunable RF preamp which covers the range of 10 to 30MHz is a natural follow-on from the 27 to 28MHz version presented just recently. The tunable unit will be found useful in giving new life to some of the older valve and transistor receivers and transceivers which are lacking in front-end performance.

by IAN POGSON

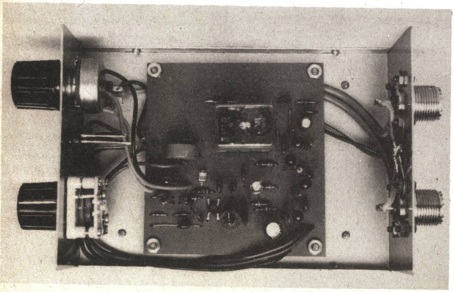
It is well known among users of high frequency receivers that, as the received frequency is increased, so the sensitivity tends to fall away. In modern receivers, the deterioration in higher frequency sensitivity is less obvious but, in some of the earlier solid-state receivers and more particularly in older valve type receivers, the effect can be quite serious.

Since the loss of sensitivity is concentrated in the front-end circuits—RF stage and mixer—it is invariably accompanied by a simultaneous deterioration in signal/noise ratio.

The performance of many older receivers can be dramatically improved, therefore, by adding an outboard RF preamplifier of modern design. To serve its purpose, such a preamplifier should be tunable over the range of, say, from 10MHz to 30MHz, where it is most needed. At the lower frequencies, the receiver's own performance should hopefully be adequate.

Modern receivers and transceivers, many with excellent front-end characteristics, stand to benefit less from the use of a preamplifier. Even so, some operators still declare that they have benefited from a preamplifier, particularly where they are operating from a bad or remote location.

In the case of mobile operation, one has to cope with a variety of problems: a compromise antenna system, acoustic and electrical noise in and around the vehicle, locations which vary from superb to terrible, and "blotto" signals from a car which pulls up alongside! Some receivers and transceivers are equal to the challenge but many are not.



Most of the components are accommodated on a single PC board. Use shielded cable between the input sockets and the relay as detailed in the text.

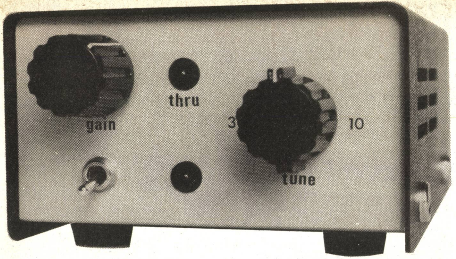
To be of any real value, a preamplifier must have a useful amount of gain, while the signal-to-noise ratio must also be as good as may be achieved with reasonable cost and complexity. In addition, the signal handling ability should be such that it will cope with strong signals without overload, and there are times when it is desirable even to invoke attenuation rather than gain.

Where a transceiver is being used, such a preamplifier is most conveniently connected directly in series with the antenna coaxial feeder, handling incoming signals but switching out of circuit instantly and automatically when the "transmit" button is pressed. This involves extra circuitry over and above the basic preamplifier function.

In practice, an automatic changeover function of this kind relies on a high-level-RF sensing circuit coupled to a DC amplifier, which operates a relay. Two sets of contacts switch the antenna straight-through during transmit, while an extra transistor simultaneously removes the supply voltage from the now-redundant preamplifier.

In cases where AM transmission is being used there is no further problem; the relay remains energised while ever the press-to-talk button is held down, because the carrier is present, irrespective of modulation.

With SSB however, RF energy falls substantially to zero during silent periods, so that the relay may tend to drop out during the breaks between words. To prevent the relay from "chattering" at word rate, time constants in the actuate circuit must be arranged so that the relay will hold in for about one second, sufficient to bridge any small breaks in speech. However, if the operator pauses for longer than a second, allowing the relay to drop out, it must close as rapidly as possible on the next word, to avoid perceptible clipping of the first syllable.



Our prototype gives about 25dB of gain and 40dB of attenuation at the high frequency end, with gain progressively greater towards the lower frequencies.

PARTS LIST

1 Metal box 103mm wide x 61mm high x 150mm deep
1 Printed board, 87mm x 79mm code 77pre5
1 Relay, 2 sets changeover contacts 185 ohms 12V
1 PCB socket for relay
1 470uH RF choke
4 Transistors, BC208, BC548, etc
1 Transistor BF115, BF494, etc
1 Transistor, MPF131
5 Diodes, 1N4148, etc
1 Diode, EM401, etc
2 LEDs, type NSL5023 or similar, with bezel
1 Neosid toroid, type 4327R/2/F25/EC
2 UHF coax sockets, type SO-239A
1 Knob

RESISTORS (½W unless stated otherwise)
1 100 ohms
1 470 ohms
1 650 ohms
2 680 ohms
1 1.2k
1 1.8k
1 4.7k
1 6.8k
1 10k
1 12k
2 22k
2 47k
1 220k
1 270k
1 10k Log pot
1 50k subminiature trimpot

CAPACITORS
1 10pF NPO ceramic
1 100pF polystyrene or NPO ceramic
2 .001 100V greencap
5 .01uF 100V greencap
1 3.3uF 50VW electrolytic
1 47uF 16VW electrolytic
1 Philips 2-gang foil dielectric capacitor, type 2222 807 10087
1 Miniature toggle switch, SPDT

MISCELLANEOUS
Hookup wire, solder, solder lugs, rubber grommet, screws, nuts.

Note: Resistor wattage ratings and capacitor voltage ratings are those used on the prototype. Components with higher ratings may generally be used providing they are physically compatible. Components with lower ratings may also be used in some cases, providing the ratings are not exceeded.

The circuit as shown meets these requirements very well, with good reports when used on the air in conjunction with an amateur band transceiver.

The unit to be described is a development from the one described earlier for use on the 27 and 28MHz amateur bands. The essential difference is in the provision of a panel controlled tuned circuit to cover the range 10 to 30MHz. Of necessity, much of the description is the same as for the previous unit but it is repeated here for the sake of completeness.

Instead of a fixed tuned input circuit, we now have a multiple wound coil on a ferrite toroid, tuned with a miniature solid dielectric 2-gang capacitor, with both sections connected in parallel. Although the gang used is very small, it has necessitated the use of a larger box to accommodate the complete unit.

The unit, as pictured, is assembled on the same printed board as used previously and there are no complicated parts to contend with. No trouble should be encountered in building the preamplifier and getting it going.

Looking first at the preamplifier section, input from the antenna is fed via one set of relay contacts into the primary winding of the toroidal coil, the secondary of which is tuned by the variable capacitor. Signals from the tuned circuit pass to the first gate of a dual-gate MOSFET, which is used because of its ability to handle large signals before overload, together with the possibility of realising a good signal-to-noise ratio. These features require careful arrangement of the DC operating conditions, which accounts for the rather unusual biasing circuitry.

Gain is controlled by varying the bias on the second gate by means of a potentiometer, a preset potentiometer being used to set the range of the control. Maximum gain should logically occur with the control fully clockwise, maximum attenuation fully anti-clockwise, with unity gain about half-way between.

The drain of the MOSFET is untuned, with a 470uH RF choke serving as the load. Signals emerging at the drain are transformed to a low impedance via an emitter follower. From the emitter follower signals then pass through another set of relay contacts to a second UHF coaxial socket and so to the transceiver (or receiver).

Considerable care was taken in laying out the preamplifier to minimise the risk of feedback and instability. A point of concern is that both the input and output have to pass through adjacent relay contacts but no difficulties were evident, probably because both circuits are at low impedance—nominally 50 ohms.

And now to the sensing circuit. In the "receive" condition there is no effective drive to the first BC208 and it does not conduct. As a result, there is forward bias on the second BC208; in this condition it deprives the third BC208 of forward bias and it is cut off. Since the relay winding is in the collector of this transistor, and as no current is flowing, the relay remains unoperated, leaving the preamplifier in circuit.

The fourth BC208 derives its forward bias from the collector of the third transistor and, in the "receive" mode, the fourth transistor conducts. Being connected as an emitter follower, it provides the supply voltage for the MPF131 MOSFET and the BF115 emitter follower.

At the moment when the transmitter is switched on, high level RF appears at the 10pF capacitor. The RF is rectified by the two 1N4148s, charging the 3.3uF and 0.1uF capacitors in parallel. This provides a source of forward bias via the 22k resistor and turns on the first BC208. In doing so, the following three stages reverse their former condition, resulting in the relay being operated. At the same time, the supply voltage is cut off from the RF amplifier and emitter follower output.

This changeover takes place very rapidly, in a matter of milliseconds.

When the transmitter is again switched off, the voltage across the 3.3uF capacitor continues to discharge for a time through the 22k resistor into the base of the first BC208, which continues to conduct. After about one second, the capacitor is discharged to the point where the transistor no longer conducts and the preamplifier becomes operative again.

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RF Preamplifier

A point to note is that the original preamp/sensor circuitry was devised for—and tested with—typical CB-style 27MHz transceivers, having a power output of about 4W on AM and 15W P.E.P. on SSB. While we have no doubt that the present unit will work satisfactorily on lower frequencies and at somewhat higher power levels, we have no way of knowing what the RF voltage and current limits would be on the particular relay.

An additional feature on this latest preamplifier is the addition of a toggle switch which, when operated, short circuits the collector of the third BC208 to ground. This operates the relay and takes the preamplifier out of circuit so that the antenna is connected via the relay contacts directly to the receiver (or transceiver input). This feature is provided so that the preamplifier can be switched out of circuit manually when it is not wanted, for instance, when operating at frequencies below 10MHz.

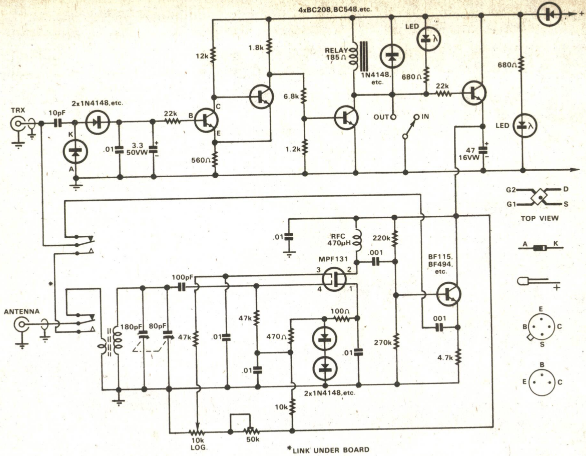
(Where the preamplifier is to be used only with a full-coverage receiver, the entire sensing circuitry and relay could logically be omitted and the switching function performed directly by a DPDT switch in the same panel position. The switch would be wired straight to the antenna sockets using short lengths of coax cable.)

But back to the unit as described: two light emitting diodes (LEDs) are used as indicators. One is across the supply, in series with a 680 ohm resistor, while the other is connected across the relay winding and glows under "transmit" conditions. This later LED also glows when the toggle switch referred to above is operated to switch the preamplifier out of circuit. We marked the switch position as "thru", short for "straight through".

The 1N4148 diode across the relay winding is to protect the transistor from possible damage from spikes induced by the relay winding as the circuit is opened. The power diode at the input of the +13V supply is added as protection against the possibility of a reversal of supply voltage polarity.

All components specified are in normal supply at the time of writing. The box which we used is distributed primarily by Dick Smith Electronics (cat. H2742) but other components are routine items for most suppliers. If for any reason, you wish to use a different box, there is no reason why you should not do so, provided that the layout is not unduly altered. This applies particularly to the input and output leads and sockets.

The tuning capacitor, as specified in the parts list, was obtained from Philips Elcoma Division and would be available to your supplier from that source. It is



10-30MHz PREAMPLIFIER

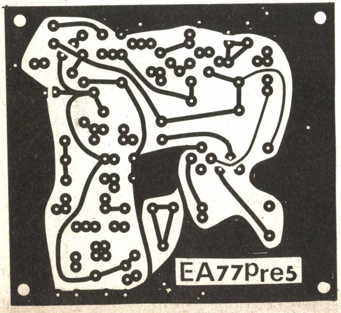
one intended for use in miniature transistor portables and has an "aerial" section with a capacitance of 180pF and an "oscillator" section of 80pF. It is similar to other miniature capacitors produced for the same purpose and, in fact, you may be able to pick up one of another brand from your supplier, or even rob one from a discarded transistor portable.

Whatever the brand, you will need to position it appropriately in the box and drill the necessary mounting holes and the clearance hole for the spindle. With the Philips gang we faced a possible problem in obtaining suitable metric mounting screws until someone realised that they were similar to those frequently stocked and used for mounting power transistors. We obtained a couple and cut and filed them to the appropriate length.

There is another potential problem in finding a knob to fit the (usually) short and metric sized spindle. We managed to find a Philips collett type knob to do the job. Another possibility is the small knurled tuning knob commonly fitted to small transistor receivers. A still further possibility would be to cement a small length of ¼-inch diameter rod to the gang spindle with Araldite or other suitable adhesive.

Construction of the main board is fairly straightforward but the usual care should be taken not to overheat any components when soldering. It is a good idea to fix the smaller components first, starting with the resistors, then diodes, capacitors, transistors, etc. Make sure that components requiring it are inserted with due regard to polarity.

The tuning coil is wound on a Neosid toroid coded 4327R/2/F25/EC. The tuned winding consists of five turns of about 22B&S enamel wire wound to



Here is an actual size reproduction of the PC board pattern.

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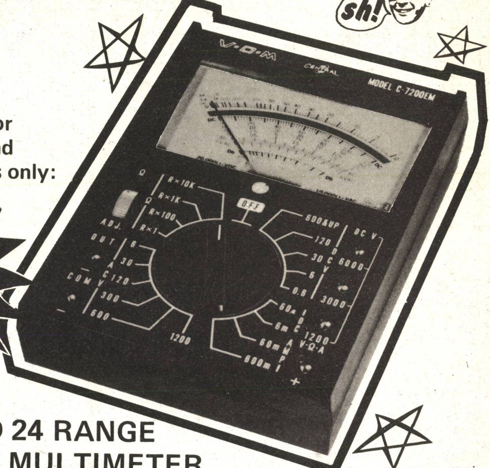

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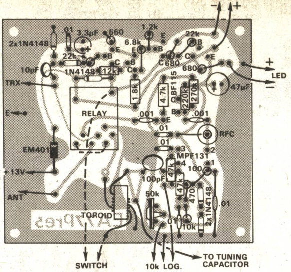


The component layout shows the PC board as viewed from the component side.

occupy about one quarter of the toroid. The aerial coupling winding consists of two turns, interwound with the tuned winding at the earthy end. Some care is needed in fitting this coil. I made use of existing holes in the board for terminations. There are two holes available for terminating the two earthed ends of the windings. The top of the tuned winding goes to the hole which connects to the 100pF capacitor and the top of the aerial winding goes to the appropriate hole provided. The coil is mounted vertically, with the windings against the board. Careful bending and tinning of each of the four leads makes final fitting easier.

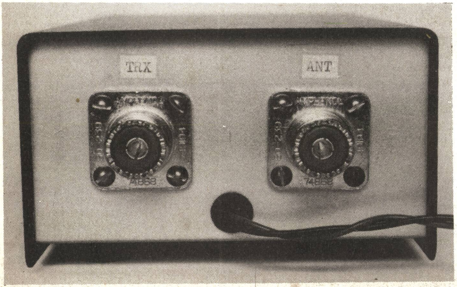
Having fixed all components to the board, leads of sufficient length should be attached for the plus and minus supply, and connections made to the two coaxial sockets (preferably in light coaxial cable), the two LEDs, the gain control and the two gang capacitor. Do not forget to tie the fixed plates of the gang together. Also, note that a link of hookup wire must be added underneath the board, across the relay contacts, as shown on the circuit.

The board assembly is now ready to be fitted to the box. Holes have to be drilled to mount the board, together with holes for the gang, gain control and LEDs on the front panel, and for the coaxial sockets and a grommet in the back panel.

The board should be mounted first, using four ⅛in Whitworth RH screws, ½in long, with the screw heads underneath. Three nuts are used on each screw to stand the board off the bottom of the box by about 8mm. Power supply leads are brought out through the grommeted hole in the back panel.

When fixing the two coaxial sockets on the back panel, a solder lug should be provided under each of the two top adjacent screws. The ends of the lugs are brought together and soldered and the outer conductor of each of the coaxial leads is terminated on these lugs. The centre conductors are terminated on the respective contacts of the coaxial sockets. The other ends of the outer conductors are soldered to convenient earth copper points on the board.

It will depend upon the type of LEDs which you use as to how they are fixed to the front panel. With the type we used, we glued the main body of the plastic holder with Araldite to the back of the panel, dispensing with the "nut" as being rather too difficult to fit. The leads of the LEDs are connected to the board by the hookup wire leads already provided.



Rear view of the prototype. Make sure that connections to the aerial and the transceiver are correct, otherwise damage could result.

At this stage construction is complete and a couple of adjustments will make the unit ready for use.

Set the gain control to maximum (rotor nearest the 50k trimpot) and set the 50k trimpot rotor in mid position. Connect a short cable between "TRX" socket and the transceiver. Connect the aerial feedline to the socket marked "ANT". **Make sure that you have these connections correct, otherwise damage could result.** Connect the power supply leads to a source of 12 to 13.5V; current will range from about 30 to 100mA, depending on operating mode.

Switch on and the power supply LED should glow. Set the tuning control to about 28 to 30MHz (rotor plates nearly right out). Incidentally, the small trimmers on the back plate of the gang should be left at the minimum capacitance position.

Next, advance and retard the gain control and determine whether there is a "flat" part at the last of its travel towards maximum. If there is, increase the amount of resistance of the 50k trimpot in circuit until gain increases continually as the control is turned up fully. If no flat is evident, the 50k trimpot should have its resistance reduced until a flat portion is evident and the trimpot should be set back until the flat disappears.

In our prototype, we were able to confirm about 25dB of gain near the high frequency end with the gain control fully clockwise and about 40dB of attenuation at the other extreme. Gain is progressively greater towards the lower frequency end of the range. By using a logarithmic potentiometer, the gain was spread conveniently over the arc of rotation, with unity gain occurring at about "2 o'clock".

The cover has now only to be fitted to the box and the unit is ready for service.

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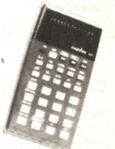

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Circuit & Design Ideas

Conducted by Ian Pogson

Interesting circuit ideas and design notes selected from technical literature, reader contributions and staff jottings. As they have not necessarily been tested in our laboratory, responsibility cannot be accepted. Your contributions are welcome, and will be paid for if used.

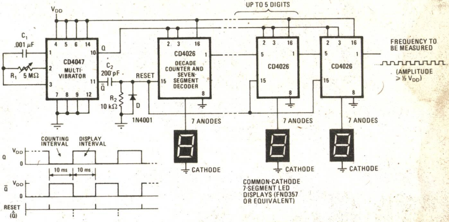
Simple frequency counter using CMOS

A handful of commonly available CMOS integrated circuits can be made into a simple digital frequency counter capable of 100Hz accuracy at 5MHz. The circuit uses only (N+1) IC packages for an N-digit display. It dispenses with display latches, extra logic for generating a count-reset pulse, and current limiting resistors for the seven segment LED display.

As the diagram shows, the frequency to be measured is applied to a series of cascaded CD4026 decade counter/decoders. The counters count incoming cycles for 10mS then drive LEDs to display the count for another 10mS. Thus the display is updated every 20mS and appears to be on continuously.

The element that controls the alternate counting and displaying is a CD4047 astable multivibrator, which generates a square wave with 20mS periodicity. When the multivibrator output, Q, is low, the clock inputs of the counter/decoders are enabled, their displays are disabled, but the counters count. When Q goes high, the clock inputs are disabled, and the count is displayed.

The counters are reset at the end of each 10mS display interval by the positive pulse obtained by differentiating the rising Q-bar output from the CD4047. The negative pulses are clamped to ground by diode D.



With values of C1 and R1 chosen to give a counting interval of 10mS, the least significant digit in the display indicates hundreds of hertz because 100 pulses per second x 10mS gives one pulse. Thus, a display of 246 indicates a frequency of 24,600Hz, or 24.6kHz. The counter is calibrated by adjusting R1 for proper reading with an input signal of known frequency.

Supply voltage Vdd may have any value from 3 to 15V. The higher the supply voltage, the greater is the range of input voltages and the faster the counting, and the brighter but more current consuming. The vaues of C2 and R2 should be chosen to give a reset pulse duration of at least 250nS. Diode D can be any general purpose diode with a peak reverse voltage of at least 2Vdd.

The same circuit can be used with a counting time of 100mS to obtain frequency resolution to 10Hz, but at such a long multivibrator periodicity, the display 50% on/off duty cycle causes objectional blinking.

(By Lloyd F. Botway, in "Electronics".)

555 timer makes flexible logic probe

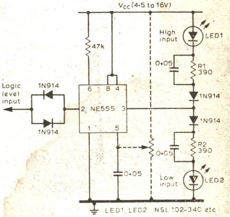
The increasing use of logic techniques has created a lively interest in the various types of logic probe used to check the operation of the devices and circuits. A flexible type of probe which is suitable for TTL, CMOS and HTL devices is described. It can be readily modified to provide accurate level detection over a range of reference levels by the incorporation of a potentiometer to adjust the potential applied to pin 5 of the 555 timer IC. The probe takes advantage of the high input impedance of the 555 and this device is capable of driving 1.6V 40mA LED indicators directly, so that only one IC is used.

It is claimed that this probe will indicate the presence of short input spikes that would otherwise be virtually undetectable (300nS pulses, spaced 500uS apart, are detectable), while a square wave input lights both LED indicators equally (visible to over 400kHz) and the ratio of indicator brightness will also provide an indication of the duty cycle of a pulse train.

The back-to-back input diodes limit the input and prevent erratic behaviour of the 555 for inputs near earth potential.

The 555 functions as a comparator with a threshold of one-third of Vcc when set by the internal bias (this reference can be varied when the potentiometer is incorporated). Output pin 3 has an inverted state to that of the input so that LED1 lights continuously on a steady high input and LED2 on a steady low input.

As shown in the circuit, R1 and R2 are compromise values allowing 1.6V 40mA LEDs to be used with supply voltages from 4.5 to 16V. If the probe is wanted only for a single supply level the values can be optimised to provide maximum light (120 ohms for TTL, or 820 ohms for CMOS or HTL). Normally the supply voltage is taken from the circuit under test.



(From "Radio Communication".)

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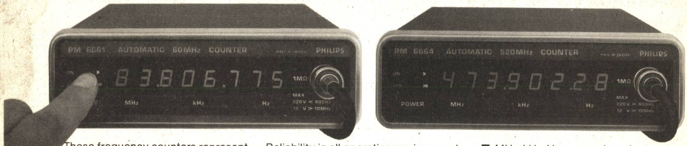

These frequency counters represent the ultimate in easy operation by having no controls, other than the on/off switch. Such simplicity is made possible by the use of advanced LSI circuitry, developed in house, which allows all control functions to be automated. The low power requirements of the Philips LSI LOCMOS circuitry also allows the instruments to be housed in a compact, rugged case without ventilation holes. Reliability in all operating environments is therefore at the highest possible level.

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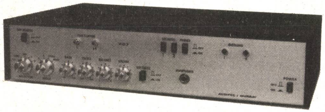

And if that sounds a little odd, then ask yourself how many amplifier tests you have seen where a really exhaustive listening test has been carried out.

When the K-07 is connected to top quality pickup cartridges and loudspeakers, it stands on its own for its ability to reproduce faithfully difficult items, especially organs, choirs and complex orchestral passages—in fact, any material which contains a mixture of transients with fine detail superimposed.

We have achieved this result by substantially eliminating transient intermodulation distortion, a brief explanation of which is as follows:

This type of distortion occurs when an amplifier is called on to reproduce wave forms that exceed the internal response time of the amplifier. In most designs, the response of the input stage is faster than that of the final stage. The input stage may then respond to the transient and, in the interval, before the output stage catches up, feedback is effectively removed and full open loop gain applies to the input signal. The input stage then overloads fully to the supply voltage or saturation current, and when the output stage has caught up, which may be only a few microseconds, the amplifier recovers in a time which is dependent on all of the internal time-constants. This may take as long as several milliseconds in a very bad case. During this settling time, all the information contained in the transient wave form which lasted for that length of time has been irrevocably lost. Thus, an amplifier which appears to give quite good performance in most respects may, in fact, be robbing the listener of much of the fine detail which was in the original recording, the lack of which may be blamed on the recording itself quite unjustifiably. Transient intermodulation distortion can also cause a spitting of harsh sound from an amplifier as well as fatiguing effect, all of which are commonly blamed on "hard to listen to" loudspeakers which may, in fact, be blameless.

Unfortunately, the trend in amplifier design in recent years has been towards the achievement of very good static measurement figures, often at the expense of the dynamic performance of the amplifier. To design an amplifier in this way is not an engineering decision, but an economic one because people compare the published figures when deciding which amplifier they will buy.

We are confident that the more thorough the listening test applied, the more noticeable will be the difference between the K-07 and its competition amplifiers.

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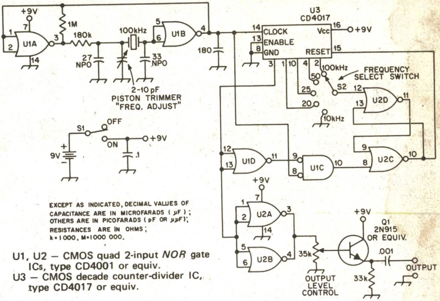
Secondary frequency standard for VHF

The secondary frequency standard shown here provides accurate calibration markers for VHF FM channels in the 144MHz band and possibly higher. Battery operation and low cost are achieved by using CMOS integrated circuits and a minimum number of components.

FM receivers and transmitters operating in the VHF range are typically crystal controlled, and they use a small value trimmer capacitor to "net" the unit on the specified channel. Without a frequency counter, it is difficult to accomplish this with any degree of accuracy. By using a secondary frequency standard with switch selectable outputs every 100, 50, 25, 20 and 10kHz, it is possible to set the transmitter or receiver on frequency quickly.

The frequency standard uses two CMOS quad 2-input NOR gates and a 100kHz crystal oscillator. The CD4017 counter is wired in a divide-by-x configuration by connecting two NOR gates as an RS flip-flop to reset the counter after x counts. The output level of the 10kHz markers is of the order of 15 to 30uV at 150MHz.

(By Alan D. Wilcox, W3DVX/WB4KRE, in "QST".)



U1, U2 — CMOS quad 2-input *NOR* gate ICs, type CD4001 or equiv.
U3 — CMOS decade counter-divider IC, type CD4017 or equiv.

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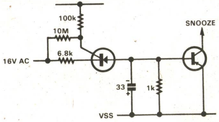
Improved "snooze" on digital clock

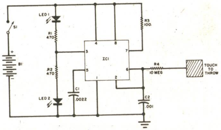
May I offer a suggestion relating to the proximity switch snooze activation on the modular digital clock as described in December, 1976. In the article, it was stated that the display shows peculiar numbers when the snooze is activated but that the extra circuitry to eliminate this was not worth the trouble. I would like to point out that this can be done by the addition of one capacitor, a 33uF electrolytic across the 1k resistor and between base and emitter of the BC558. In addition, I found that the 10M resistor had to be reduced to 1M to avoid excessive sensitivity.



(By Mr K. M. Briggs, Department of Mathematical Physics, The University of Adelaide, Adelaide, South Australia 5001.)

Coin flipper using 555, two LEDs

A 555 timer is used as the basis for an electronic "coin flipper" featuring red (LED1) and green (LED2) visual readouts. With power on, the circuit is operated simply by touching a small metallic plate. In addition to the 555 and the two standard LEDs, all that is required for assembly is four half-watt resistors, two small ceramic or plastic film capacitors, an STST switch, a 9-15 volt battery, a small touch plate (about 1cm on each side), wire, solder, a suitable case and mounting hardware. Component values are not overly critical and 1k resistors may be substituted for the 470 ohm units specified for R1 and R2 to reduce battery current drain.



(From "Popular Electronics".)

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Dual regulated supply

With MOS-LSI integrated circuits becoming more common, we felt the need in our laboratory for a power supply capable of providing the two voltages commonly required by these chips. It was only after the initial design work had been completed, however, that we realised how versatile such a supply could be, and that it was eminently suitable for a project.

by DAVID EDWARDS

The initial spur to the development of this project was a need for +5V and −12V to power a prototype project. While these voltages could have been provided by two separate variable supplies connected in series, we felt that this was not the best solution.

The chief disadvantages of such an arrangement are as follows: firstly, it ties up two separate supplies, and supplies are always in short supply (sorry!) in our laboratory. They also tend to "migrate" to other staff members' benches. Secondly, there is a distinct possibility that the supply voltage settings may be accidentally maladjusted, with possibly fatal results to the circuit under test.

Having thus decided that a dedicated power supply would be a worthwhile addition to our laboratory equipment, it remained only to design and build it. In the interests of economy and ease of availability, we decided to make use of the 2155 type transformer.

This transformer is available from at least two different sources, and has been used in many of our previous projects. It has a variety of taps, with maximum output voltage being 15V, at a current drain of 1A.

The next design decision concerned the way in which the raw DC, obtained from the transformer via suitable rectifier/capacitor combinations, would be regulated. Our immediate choice was to use three terminal regulators, on the grounds of ease of design, good regulation, short circuit and overload protection.

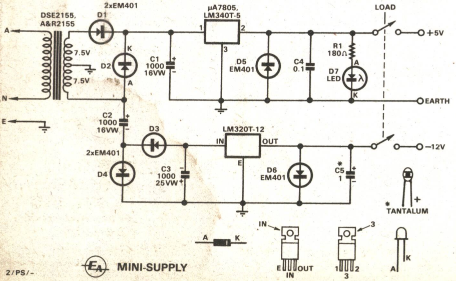
Let us first consider the design of the +5V supply. The transformer is connected as a centre-tapped bridge, with diodes D1 and D2, and capacitor C1 providing a nominal output voltage of 10V.

A uA7805, LM340T-5.0 or similar three-terminal positive voltage regulator is then used to improve the ripple and provide regulation of the supply. C4 is connected directly across the regulator output, and ensures stability with most types of loads. It also improves the transient response.

These regulator chips are virtually indestructible. With adequate heat sinking, output currents in excess of 1A can be delivered. Current limiting is provided to limit the peak output current to a safe value during short circuits. Safe area protection is provided for the internal pass transistor, as well as thermal shutdown circuitry which protects the device in the event that the internal power dissipation becomes excessive.

For the negative side of the supply a voltage doubler, formed by diodes D3 and D4 and capacitors C2 and C3 is used to provide an unregulated −20V rail. This is then smoothed and regulated using a second three-terminal negative regulator. We have specified an LM320T-12 device, which has similar specifications to the uA7805, except that it is a negative regulator.

C5 is a 1uF tantalum capacitor, required to ensure stability. This is the



PARTS LIST

1 uA7805, LM340T-5.0 or similar 3 terminal 5V regulator
1 LM320T-12 or similar 3 terminal 12V negative regulator
6 silicon diodes, EM401 or similar
1 light emitting diode

CAPACITORS

1 1000uF 25VW pigtail electrolytic
2 1000uF 16VW pigtail electrolytics
1 1uF 35VW tantalum
1 0.1uF polyester

MISCELLANEOUS

1 180 ohm ½W resistor
1 15VCT @ 1A transformer, DSE 2155,

minimum required to ensure stability; larger values will improve the transient and noise performance.

D5 and D6 are required to ensure that both regulators will start up when power is first applied with a large common load (a common load is one connected between the +5V and −12V rails, with no connection to ground). Both diodes are reverse biased during normal operation.

A DPDT miniature toggle switch has been provided to enable the load to be disconnected. D7, a light emitting diode, and R7, a current limiting resistor, are connected across the +5V rail, and function as a pilot light. We felt that this was necessary, as no mains switch has been provided.

Our prototype was capable of supplying in excess of 800mA from the +5V terminal, with a ripple voltage of less than 10mV p-p. This was measured with no load on the −12V rail. With the +5V rail unloaded, we were able to sink in excess of 350mA into a −12V terminal, with a ripple of less than 2mV p-p.

On no load, the ripple was less than 1mV p-p for both rails. If both rails are loaded together, the currents obtainable from each rail will be reduced somewhat, due to the increased loading on the transformer.

If you have a requirement for supply voltages other than those provided by our prototype, these requirements can be met by simply using a different set of regulators. To get a −5V rail for instance, simply reverse D1, D2, C1, D5 and D7, exchange the uA7805 for an LM320T-5.0, and replace C4 with a 1uF tantalum capacitor.

Do not forget that the input terminal of the regulator will then have to be insulated from the chassis, using a thin mica washer to maintain a high thermal conductivity.

Similarly, to obtain a +15V rail in place of the −12V output, simply reverse D3, D4, D6, C2, C3 and C3, and replace the regulator with an LM340T-15, or similar device. C5 need then only be a 0.1uF polyester capacitor.

If two or more voltages of the same polarity but differing in value are required, they can be provided by adding more regulators in parallel, using the same rectifying diodes and capacitors. If large currents are required from all rails simultaneously, it will be necessary to increase the size of the filter capacitors and the transformer.

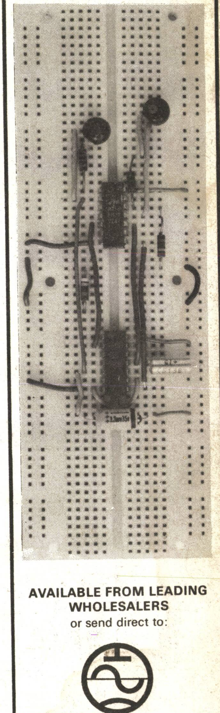
For output voltages less than 8 volts, use the full wave bridge arrangement like that shown with D1, D2 and C1. For higher voltages than this, use the voltage doubling arrangement like that shown with D3, D4, C2 and C3.

As you can see from the photographs, construction is quite simple. We assembled our prototype in a small utility case kindly supplied by Dick Smith Electronics Pty. Ltd. It measures 61 x 103 x 150mm, and is supplied complete with

A&R 2155 or similar
- *1 mains cord, plug, grommet and clamp*
- *2 10 lug tagstrips with 2 mounting feet*
- *1 DPDT miniature toggle switch*
- *3 terminals, 1 red, 1 black, 1 green*
- *1 case, 61 x 103 x 150mm*

Hookup wire, solder, solder lugs, machine screws, nuts and washers, heatsink compound, mica washer, nylon machine screw and nut

NOTE: Resistor wattage ratings and capacitor voltage ratings are those used for our prototype. Components with high ratings may generally be used provided they are physically compatible.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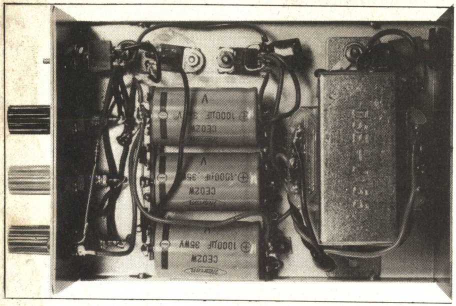


ABOVE: This photograph of the interior of the prototype should be used as a guide to the placement of components.

rubber feet.

The transformer is mounted centrally to the rear of the case, with the mains cord entering through a grommetted hole, and clamped to the chassis. The earth lead is also connected directly to the chassis, while the active and neutral leads are connected directly to the transformer.

The three filter capacitors are mounted between the two tagstrips, with the rectifying diodes mounted on the tagstrips. The regulators are mounted on the bottom of the chassis, with the output capacitors and diodes soldered directly across their terminals.

The negative regulator must be insulated from the chassis, using a mica washer and nylon machine screw or similar device. The positive regulator can be bolted directly to the chassis. Both regulators should be thermally bonded to the chassis using silicone grease.

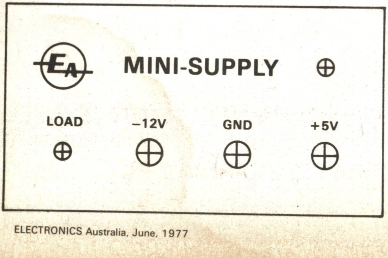
The wiring to the switch and to the output terminals is made using hookup wire, while the LED and associated resistor are wired between the +5V output of the regulator and the chassis ground.

Do not omit to clean the paint from underneath the positive regulator, and to ensure that all ground points are reliably connected together. This is best done by linking them with hookup wire.

The front panel on our prototype was made using "Scotchcal" photo-sensitive aluminium. We have reproduced it full size elsewhere in this article. An alternative is to make a panel from pressure sensitive lettering.

This latter approach would lend itself particularly to supplies which have different output voltages from the prototype.

BELOW: This actual sized reproduction of the front panel of the prototype can be either copied or used directly.



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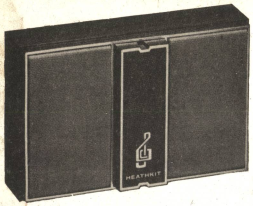

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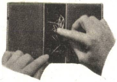
The TD-1089 is loud enough to be heard throughout normal size homes, but you can add extra 16-ohm speakers to the "extension" terminals and spread the sound to other areas.



The TD-1089 is easy to program. Just remove the decorative front panel to change programming leads and make adjustments.

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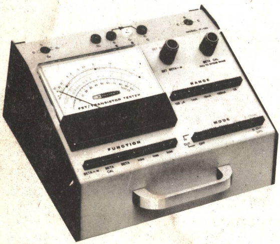

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Adding a cursor to our Video Terminal

Many readers who have built the Video Data Terminal have expressed interest in the idea of adding a cursor facility. Here are brief details of a low-cost modification to do this, supplied by Ed Monsour the designer of the EME-1 video display module.

The Video Data Terminal described in our issues for January and February 1977 has been very popular, with considerable numbers having been built not only by individuals but also by colleges, universities and other institutions.

One of the things which both builders and would-be builders have enquired about is the possibility of adding a cursor facility, so that one can see at a glance where the next character will be added to the display. This facility can certainly be very handy, removing any doubts caused by distractions and lapses of memory (. . .concerning whether or not you pressed the CR and LF keys at the end of the last line, for example!).

In response to these enquiries, Ed Monsour the designer of the EME-1 video module used in the terminal has worked out details of a low cost modification to provide a cursor facility. And he has very kindly supplied us with the details, to pass on to readers.

The circuit for the modification is shown at right. As you can see it involves a relatively small number of parts.

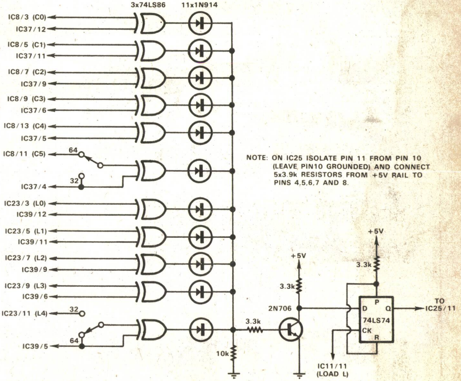
Basically the circuit is a coincidence detector monitoring the write address and read (display) address counters, and whose output is used to control the chip enable pin of the 2513 character generator chip IC25.

Each of the ex-OR gates compares corresponding character and line address bits of the two counters. While ever there is at least one bit-pair different, one gate output is high and the transistor is held on via the 11-diode OR gate. This keeps IC25 enabled, via the flipflop driven from the active-low LOAD signal.

However, when all bits of the addresses coincide, all ex-OR outputs go low, and the transistor is cut off. This causes the flipflop to disable IC25, for the duration of one character-row. As this will happen for each row, a bright solid rectangular cursor is displayed.

If desired the cursor could be made optional, using a shorting switch across the 2N706 transistor (collector-emitter).

Incidentally Ed Monsour is able to supply a kit for this modification, as you can see from his advert below.



NOTE: ON IC25 ISOLATE PIN 11 FROM PIN 10 (LEAVE PIN10 GROUNDED) AND CONNECT 5x3.9k RESISTORS FROM +5V RAIL TO PINS 4,5,6,7 AND 8.

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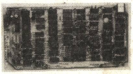

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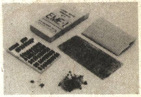

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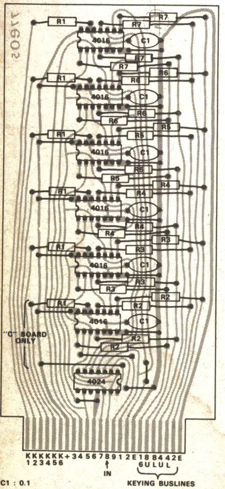
Alternative MOS keyer for larger "760" organs

Those building, or planning to build larger organs based on our Playmaster 760 design should find this article of particular interest. It describes an alternative MOS keyer module which reduces by about 75% the wiring needed to provide a manual with 4-pitch keying. Further information is also given on stop filter circuits.

by JAMIESON ROWE

As I explained in the August 1976 article which presented the design for a MOS keyer module for the Playmaster 760 organ, that module was designed mainly for the relatively large number of constructors wishing to build a fairly modest instrument. While provision was made for use of multiple rows of keyers, as would be required for a more pretentious instrument, the needs of the larger organ builder were not allowed to slant the module design too far—this would have made the majority of builders pay for provisions they would probably never use.

I think these aims were realised reasonably well, in that the first keyer module does make wiring of a smaller organ quite straightforward and low in cost. And while it is also possible to use further slave keyers to expand a design quite cheaply, there is a penalty: quite a lot of tedious and time-consuming wiring. I have found this out the hard way myself, having to date only partly wired up a moderate-sized 2-manual classical-type instrument!



C1 : 0.1
R1 : 470k
R2 : 100k (ON C BOARD ONLY)
R3 : 100k
R4 : 120k
R5 : 150k
R6 : 180k (F#-B) 220k (C-F)
R7 : 270k (F#-B) 330k (C-F)

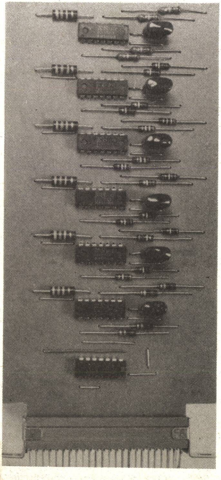


Fig. 2 (left) shows how to wire up the new module. The picture above shows it as wired for a "C" keyer.

The builder of a larger organ shouldn't expect to be able to wire it up in a few evenings, of course. But having now spent quite a large number of evenings, I am quite prepared to agree that the work should be minimised in every possible way!

To cut a long story short, I have produced a second MOS keyer module design specifically to help builders of larger organs. What the new keyer module does is reduce quite drastically the wiring required for the four octave-related pitches most often used: 16ft, 8ft, 4ft and 2ft.

The new keyer design does not supersede the first, but rather it will tend to complement it. For small instruments, or manuals of larger instruments which involve fewer than 4 pitches, it would still be better to use the original design. And it will still be necessary to use the original keyers where mutation pitches are required. But wherever a manual requires the four main octave-related pitches, the new keyers will generally be worth using.

How does the new keyer module differ from the first? Well, the actual keying circuitry is basically the same. But instead of simply providing a row of keyer ICs to be wired in simple chromatic order, the new module has all of the keyers for notes of the same name grouped together. All of the C keyers are on one module, all of the C-sharp keyers on another, all of the D keyers on another and so on.

So there are a total of 12 modules used per manual, one for each of the 12 notes of the tempered chromatic scale.

By grouping all of the keyers for a given note-name together on a single PCB module, it becomes possible to take advantage of the relationships between octave-related pitches. Thus the note keyed by the highest C-key on a manual for 16ft pitch is the same note keyed by the next highest C-key for 8ft pitch; it is also the same note keyed by the next C-key again for 4ft pitch, and finally the same note keyed by the fourth C-key for 2ft pitch. The same relationships apply to the other notes.

With the keyers grouped together on a single PC board, the copper pattern of the PCB can thus be used to perform a lot of the keyer interwiring.

Not only this, but it also becomes possible to reduce external wiring still further, by incorporating in the module the divider IC for the note concerned. This means that only the highest-pitch version of the note need be supplied to the keyer module from the tone generator—the PCB wiring and the ICs do the rest.

Wiring up a set of keyers for a 61-note manual with 4 pitches using the new keyer modules thus involves only about 80 external wires: the 61 wires from the keyswitches, 13 wires from the tone generator, and the supply and keying busses. This compares with around 340 wires for the same manual and pitches using the original keyer modules—a saving of around 75%.

Of course the new keyer design can only cope with octave-related pitches, because these are generally the only ones which use common notes. So if you want mutation pitches like 2-2/3ft and 1-3/5ft, these will still have to be provided using a row of the original keyer modules. However a single row of the original keyers will give you two such pitches, so that in most cases it shouldn't be necessary to wire up more than a single row.

For a 61-note manual with a total of six pitches, for example—16ft, 8ft, 4ft, 2-2/3ft, 2ft and 1-3/5ft—you will need 12 of the new keyer modules and 4½ of the original modules.

The new keyer modules are based on a single PCB pattern, which is used for all notes—although only the C keyer will have all the IC keyer stages wired (because there are 6 "C" keys on a standard 61-note manual, whereas all other notes have only 5 keys).

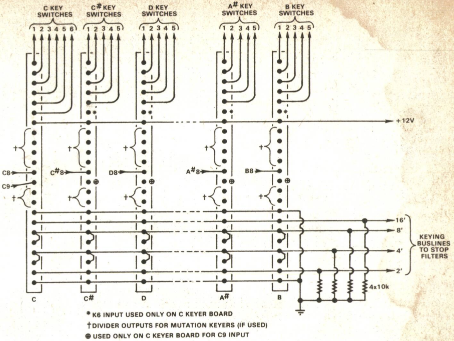

C KEY SWITCHES
C# KEY SWITCHES
D KEY SWITCHES
A# KEY SWITCHES
B KEY SWITCHES
1 2 3 4 5 6
1 2 3 4 5
+12V
†
C8
C9
C#8
D8
A#8
B8
⊕
16'
8'
4'
2'
KEYING BUSLINES TO STOP FILTERS
4x10k
C
C#
D
A#
B
* K6 INPUT USED ONLY ON C KEYER BOARD
† DIVIDER OUTPUTS FOR MUTATION KEYERS (IF USED)
⊕ USED ONLY ON C KEYER BOARD FOR C9 INPUT

Fig. 3: How to connect up a set of 12 of the new keyers to provide four pitch keying for a standard 61-note manual. Note the small amount of wiring involved.

As the divider for each note is now included on the keyer module, the various notes are brought out for external use as well as being fed to the various keyers within the module. They are thus available for use by mutation keyers, if required.

This means that the dividers on the tone generator module will not really be required if the new keyers are used. So if you haven't wired the tone generator yet, don't wire them in. But if you have already wired up the tone generator with them in, there's no great harm done—they can be used for additional note sources for pedal keyers, etc.

The PCB pattern for the new keyer module is coded 77eo5. It measures 170 x 83mm overall, with a 24-way edge connector at one end. An actual size reproduction of the pattern is shown in Fig.1 for those who wish to make their own boards, although boards should be

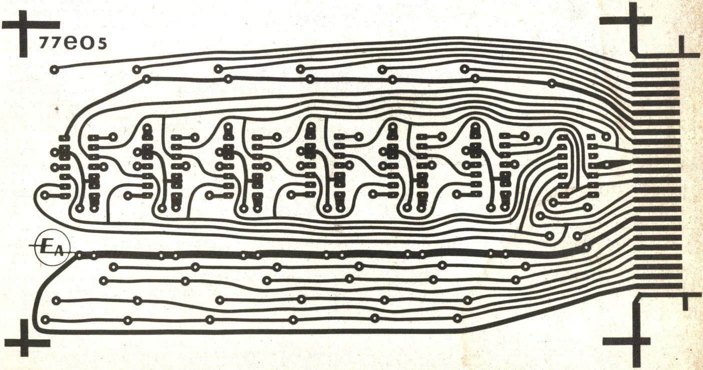


Fig. 1: Here is the PCB pattern for the new module, reproduced actual size to allow copying or tracing.

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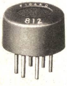

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available from commercial suppliers shortly. A set of prototype boards for testing the module design was kindly supplied by RCS Radio Pty Ltd, of 651 Forest Road, Bexley, and I understand that they will be making the boards available with gold-plated edge connector pads for reliable long-term performance.

Fig.2 shows how to wire up the new boards, and also the edge connections. Note that the first 4016 keyer stage up from the 4024 divider IC is used only on the "C" keyer module. The modules for all other notes use neither this 4016 IC nor its associated components (the keying resistor R1, capacitor C1 or the four mixing resistors R2).

Because it is not easy with the new keyer modules to fit additional resistors into the keying buslines, to provide balancing across the manual compass, I have adopted the alternative idea of varying the mixing resistor values. This is the reason for the increasing values shown for R2 and R3, R4, R5, R6 and R7. The last two are given different values for different notes, as you can see, to allow adequate balancing to the two lowest octaves.

Fig.3 should make it clear how a set of the new keyer modules are wired up to provide normal 4-pitch keying for a manual. As you can see the K1–K5 inputs of each module are connected to the keyswitches for the notes concerned, with the "C" keyer also having the K6 input going to the top-C keyswitch.

The actual keyswitches should be wired as shown in Fig.7 of the August 1976 article, according to whether they are of the SPST or SPDT variety. For SPST switches you will have to fit a 100k shunt resistor to ground on each keyer input, to pull it down when the switch is in the open or "key up" position.

The main note input to each keyer module from the tone generator is via the "8" input, as you can see, with the "C" module also having a second input via the "9" input. This provides the 2ft note for the top-C keyer.

As the legend on the diagram explains, the remaining note positions on the edge connector sockets are provided for driving mutation keyers. If you aren't using such keyers, or are supplying them from the main tone generator directly, these connector pins are not used.

All of the remaining connections to the 12 keyer modules are made in parallel, as shown, making the wiring very straightforward. There is a single +12V supply line, but two earth lines to provide a measure of shielding for the keyer output buslines.

As you can see the buslines themselves are each provided with 10k load resistors. These are to provide adequate mixing of the keyed notes on each line, so that the volume rises realistically as more keys are depressed.

The 8ft and 4ft buslines each connect to two edge connector pins on each module, and as shown the two pins are normally strapped together. The reason for the two pins is that the keyer module has provision for "splitting" the lowest two octaves of the manual away from the rest, for these two pitches.

Unless you do want to make use of this facility, simply strap the two pairs of pins together as shown in Fig.3.

The mixed squarewave signals which appear across the four load resistors become the input signals for the stop filter circuits. They are used either individually or mixed together in suitable proportions, depending upon the tone colours to be generated. This was discussed in basic terms in the August 1976 article, you may recall.

Thus for flute and tibia stops of the various pitches, one generally uses the squarewave signals separately, because these tone colours involve filtering the signal down to an almost pure sinewave. There is little point in adding harmonics only to filter them out again!

Similarly the squarewave signals are also used alone for stops like stopped diapason, gedackt and clarinet, because these tone colours are characterised by only odd harmonics. These are provided by a squarewave, so it is mainly a matter of filtering out those not required.

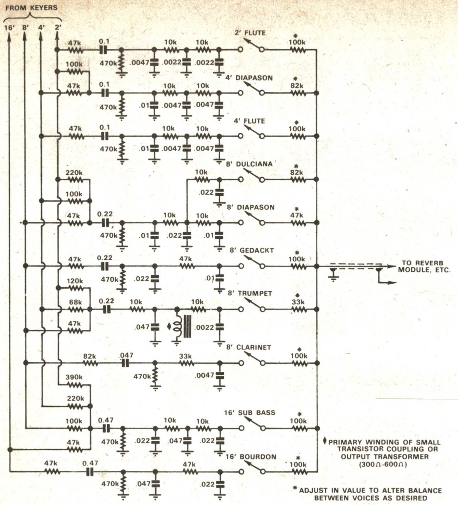
On the other hand for stops like open diapason, trumpets or other reeds, and various string-tone stops, it is generally desirable to mix suitable signals from the keyer buslines. This is because these stops have tone colours characterised by even harmonics as well as odd, and even harmonics are not present in a square wave.

The signals are usually mixed in an inverse ratio to pitch, as explained in August 1976. This gives a "sawtooth" or "staircase" waveform for a single keyed note, with a raw harmonic content fairly appropriate for diapason tone colour (after filtering). However the mixing proportions are by no means fixed, and in fact they may be varied to adjust the tone colour of stops as desired.

For string tone stops, or "bright" diapasons, the proportion of higher pitch signals mixed with the fundamental may be increased significantly. This may also be done with trumpet stops and other reeds.

To provide some guidance along these lines, a set of representative stop filter circuits are shown in Fig.4. These are suitable not just for use with the new keyer modules, but with the original keyers as well.

As you can see, the flute tone-colours use the keying bus signals individually: 2ft Flute uses the 2ft signal, 4ft Flute uses the 4ft signal, 8ft Gedackt uses the 8ft signal and 16ft Bourdon uses the 16ft signal. The 8ft signal is also used separately by the 8ft Clarinet filter.



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SIMPLE STOP FILTERS FOR OCTAVE RELATED PITCHES

Fig. 4: Here are some simple stop filter circuits for the four main octave-related pitches. The text discusses how to vary these for other stops, and also how to provide filters for mutation pitches.

On the other hand the diapason tone-colours use mixed signals, wherever these are available. Thus the 8ft Diapason and 8ft Dulciana (which is a soft or "echo" diapason) circuits are fed from a mixture of the 8ft, 4ft and 2ft signals, while the 16ft Sub Bass is fed from a mixture of the 16ft, 8ft, 4ft and 2ft signals. Similarly the 4ft Diapason (which might also be called a 4ft Principal) is fed from a mixture of the 4ft and 2ft signals.

The 8ft Trumpet filter is also fed from a mixture of the 8ft, 4ft and 2ft signals, but with the proportions of the higher pitches increased to give a brighter tone.

The stop filter circuits shown in Fig. 4 are fairly basic, but they should provide a good starting place for experimentation.

If you want string tone colours like Salicional or Gamba, I suggest that you start with the circuit shown for 8ft Diapason (or 4ft Diapason if you want a 4ft string stop), and modify the input mixing resistors to give a higher harmonic content. You could also try reducing the values of one or more of the filter capacitors. Remember that the stop name Salicional generally implies a fairly soft, transparent string stop, whereas Gamba and Violin stops are generally louder with more body.

Other reed stops like Oboe, Bassoon (Fagotto) and Trombone can be produced by taking the circuit shown for the Trumpet, and changing the resonant frequency of the L-C formant. Increasing the resonant frequency by reducing the capacitor value across the inductor tends to produce a thinner, reedier sound, while reducing the resonant frequency by increasing the capacitor value tends to give a rounder sound. You can also vary the R-C filter after the resonant circuit, to alter the upper harmonic content.

Although Fig.4 shows no mutation stops, the filters for these tend to be fairly easy to adapt from those shown. For example if you have a 2-2/3ft signal available from the keyers, you can produce a 2-2/3ft Nazard stop by using the same circuit as that shown for the 4ft Flute, but with the filter capacitor values reduced to around 75% of their present value—i.e., about halfway between the values shown and those for the 2ft Flute.

Although a traditional Twelfth stop is also a 2-2/3ft stop, it is not easy to produce this using a square-wave signal because of the absence of even harmonics (Twelfth should be a diapason tone colour). However, you could perhaps produce a passable substitute by taking the Nazard circuit just described and reducing the capacitor values so that the harmonic content rises.

Assuming you have a 1-3/5ft signal available from the keyers also, you can produce a Tierce stop in much the same way as the Nazard. Here the idea would be to use the circuit shown in Fig. 4 for the 2ft Flute, and reduce the filter capacitors to about 75% of the values shown.

Incidentally, if you have keyers producing 4ft and 2ft signals along with 2-2/3ft and 1-3/5ft mutation pitches, you could also produce mixture stops by mixing these pitches in suitable proportions. For example, although I haven't tried it as yet, it should be possible to produce a reasonable imitation of the traditional Cornet mixture by using a circuit rather like that shown for the 4ft Diapason, and feeding it with the two mutation pitches through 100k resistors.

Don't be afraid to experiment with other ideas, either. For example if you have 2-2/3ft signals available from the keyers, try mixing them into circuits like those shown for the 8ft Gedackt and the 4ft Flute. You may be able to produce interesting changes in tone colour in this way.

A final point. Note that the resistors in Fig. 4 marked with an asterisk may be varied in value to change the loudness of each stop. This can be used to balance the stops with respect to each other. I suggest that you don't reduce the resistor values below about 33k, however. Lower values tend to upset the stop mixing action. which leads to strange effects, like the overall volume dropping when you bring in additional stops!

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DSE 4 EA 67

Forum

Conducted by Neville Williams

Should we take "P.R. blurb" seriously?

Reference in a recent letter to "P. R. Blurb" brought with it the realisation that, while P.R. (Public Relations) releases are part of the environment in an editorial office, they have never before received honourable mention in these columns. Well, here goes!

The letter in question comes from a reader—and a fairly regular correspondent—from Ewey Bay in New South Wales:

> *Dear Sir,*
>
> *After wondering whether I was supposed to laud or to laugh at two articles in the April issue of "Electronics Australia", I concluded that it was meant to be cases of "what you will". I refer to the record release story and to the electric car.*
>
> *My votes and why:*
>
> *A reference to a newly discovered principle of electroacoustics should have accompanied the record article for me to take the P.R. blurb seriously.*
>
> *As for the electric car, I place it in the same category as the ermine toilet seat cover.*
>
> *R.S.C. (Ewey Bay, NSW)*

Well now, as far as the record release story is concerned—"New Quality Label . . ." page 7—R.S.C. qualifies for no special award in deducing that readers were expected to attach to it whatever importance they so chose.

That was precisely our intention!

The lead-up text pointed out that, while other record manufacturers have concentrated at various times on different aspects of technology, Fulton Records seemed to be pre-occupied with microphone type and placement. Following a reference to not sparing the adjectives, we quoted a segment of their P.R. material to illustrate the degree of dedication to this aspect.

Having quoted same, we drew attention to the way it ran parallel to so-called "purist" concepts and to the fact that Fulton Records were laying at least as much emphasis on the technology as they were on the program content. Our reviews covered both aspects; we believe fairly and objectively.

If R.S.C. felt that he'd heard it all before, even to possessing other "purist" recordings, then the story was clearly not for him.

But I can assure R.S.C. that there were others who had not heard it all before, or who were more than happy to buy a couple of albums to judge for themselves what all the technical and/or P.R. jargon (or "blurb") added up to in practice. And, at this point, the judgement becomes highly subjective, depending on how individuals rate the various factors that lead to the production of the albums that actually go on to their turntable, and to which they either do or don't like listening.

In case this sounds like a put-down of the Fulton albums, I should make this point: my personal copy of "Organ Music From Westminster" is getting more than its fair share of playing in our lab. by people who are evaluating the bass (and overall) performance of loudspeaker systems.

But, getting back to the original theme, the P.R. man(?) epitomises one of the groups which is traditionally involved in marketing a new product:

- The Advertising Department buys space or time in the media, assembles advertisements and has them published—at a price.
- Sales representatives try to make contact with potential high volume customers and explain the product to them individually.
- The P.R. man seeks to stir up media and public interest in the product by so exposing it that it will be treated as "news" and publicised free.

". . . in the same category as the ermine toilet seat cover!"

Public Relations may involve a part-time job for somebody, or a full time position or department within the company, or yet the services of an outside public relations organisation. But while the scale of the P.R. exercise may vary, the P.R. person's problem remains the same: somehow or other, they have to turn the product into "news" which will be picked up as such by editors and noted (hopefully with interest) by the ultimate readers.

Some products are intrinsically newsworthy, and they're the easy ones. They may be new, in a sense that consumers can readily understand; they may be intriguing, startling, even spectacular.

The electric car would come into this category, particularly one as imposing as "Transformer 1" featured in our April issue. I fully agree that there have been many earlier attempts to develop viable electric cars and R.S.C. may be excused for equating this one to an "ermine toilet seat cover". But with pressure around the world building rapidly towards the conservation of fossil fuels and a reduction in atmospheric pollution, electrically propelled vehicles are beginning to look a lot more attractive.

I'm not quite so sure about ermine seat covers!

The problem products, from the P.R. point of view, are those which are not intrinsically newsworthy. They may be the result of mainly "cosmetic" changes, or of model changes with only modest technical improvements. Or they may simply flow from changes in manufacturing or marketing philosophy.

There are plenty of such examples to be found in the electronics industry and the perspiring P.R. executive has to work out some kind of an "angle" for the stories and pictures. And when all else fails—and even if it doesn't—he/she can always get a pretty girl to display the goods!

Every month, we get our share of pretty-girl pictures, with supporting copy; we get our share of "angle" stories, and we get others where the writer has used every trick of circumlocution to stretch a simple message over a couple of pages. And, of course, we get those notices which have defied the interpretive powers of P.R. personnel, to emerge as something comprehensible only to those who know the jargon. Release notices for new logic integrated circuits are a prime example.

Our job in the editorial office is to sort out the ones we can use, simplify the ones that are too complex, give meaning to the ones that are garbled, discard the surplus adjective, sentences and paragraphs, and so on, ad tedium! We like to think we make a reasonable fist of it.

With the audio/hifi industry, as mentioned by R.S.C., the position is vastly complicated by the fact that many of the people behind design, development and marketing are fervent enthusiasts, responding to highly subjective judgements. They can become quite obsessed with particular parts of the system, and with particular approaches to those parts, tossing aside other known problem areas with scarcely a second thought.

Such people can promote their own ideas and products with tremendous fervour but, in addition, they can motivate P.R. professionals to excesses of enthusiasm. When we fail to jump out of our editorial chairs, and look puzzled rather than ecstatic, we're made to feel like knockers of the worst kind: unperceptive, unenterprising, shackles on the forward march of technology!

Overall, however, caution hasn't proved too bad a policy.

Very obviously, Fulton Electronics, mentioned in our April article and in R.S.C.'s letter, were completely taken up by microphone design and placement, seeking to capture the sound in a way which would obviate the need for subsequent manipulation of the signal at the control console. Little or nothing was said about the rest of the recording and reproducing chain. As Fulton saw it, the hindrance to vital, "alive" recording was right there, in the original auditorium.

However, if you turn back to the November '76 issue, you'll find on page 9 a story and explanation of the PCM (Pulse Code Modulation) system used in the production of Denon brand recordings, distributed in Australia by AWA. Here, microphone and console arrangements are taken for granted and attention focuses on getting the signal from the console to the cutting head with a very minimum of added noise and distortion. Someone had obviously put a tremendous amount of time and effort into developing the particular method and one might almost have concluded that, beside it, records using other systems must sound dated and "crummy".

Our final comment sought to dispel this possible impression. The Xenon records were good and the PCM system might offer a way to sustain such quality; but, on the samples available, hifi enthusiasts could not expect sound better than from their best existing analog system pressings.

Then cast your mind back to RCA and their introduction of the "Dynagroove" recordings. Forget the microphone, forget the mixing, forget the mastering; the real problem was to cut a groove which would not present impossible amplitudes or transients to practical pickup cartridges. Get the groove geometry right and you could enjoy the benefits of

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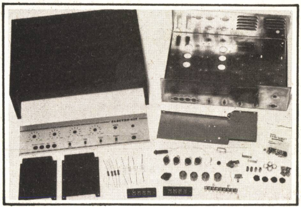

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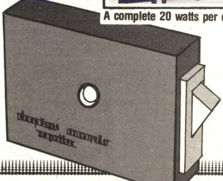

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Forum continued: P.R. blurb?

wide dynamic range without its problems! RCA really went to town on that subject.

But then, it's not so long ago that we received some no less enthusiastic material in which the emphasis was on specially shaped styli, which could contribute significantly to the tracking and tracing of all records to produce a smoother, cleaner sound. One gained the impression that, no matter how hard a cartridge manufacturer may have tried with his spherical, bi-radial or other styli, fitting one of the new ones would make that subtle but all-important difference.

It didn't quite gel with the impression from cartridge literature that the key to good tracking and tracing was in the mechanism and the supporting arm, an effective stylus being taken for granted!

All of that preceded the current talk in Australian hifi circles about the Auditec K07 amplifier, designed by C. T. Murray of Sydney University, and described in our March issue. In conversation with the writer, Mr Murray was firm but restrained in his claims for the design, but not so some of the people who are using the amplifier.

They seem quite convinced that many of the problems that have traditionally been blamed on sound sources, records, styli and cartridges are, in fact, manifestations of transient intermodulation distortion (T.I.D.) triggered within the majority of amplifiers that hifi enthusiasts are currently using. Install one of the new Murray designed amplifiers and you'll discover a whole new world of TID-free sound. Some of your imagined loudspeaker problems will disappear, too!

I am not exaggerating; merely paraphrasing.

But, of course, there have been other amplifiers from overseas which have likewise received an enormous amount of publicity, also flowing from development work. For example, Yamaha and Sony came out with models using power FETs in the output stages, thereby getting back to the commendable "valve" techniques of avoiding cross-over distortion and placing generally less reliance on negative feedback. They made existing technology seem rather "old hat", although old-hat technology has since proved to be remarkably durable!

And, of course, there was the QUAD current dumping amplifier which offered its own unique answer to the problems of the output stage, with the possible conviction that it, too, had set a new level of achievement.

As for loudspeakers, that's where the enthusiasts and P.R. people have really had a picnic.

Some designers see merit in simple cross-over networks, because of their minimal phase irregularities. Others opt for the complicated approach on the basis that it is quite essential to limit the bandwidth of signals fed to the respective drivers.

Some insist that drivers must be concentric to avoid phasing problems, others use separate drivers but stagger them in such a way as to maintain alleged phase linearity. Still others discount the whole phasing idea and even point drivers in all directions to achieve what they consider more important: a spacious sound.

And so on: sealed, ported, large, small, rectangular, triangular, round, up on legs, flat on the floor . . . etc.

It is little wonder that consumers become confused and magazine writers become blase.

Perhaps we should sack all P.R. executives, limit all advertisements to a picture and a list of specifications, prevent designers from enthusing at lectures and demonstrations, and eliminate subjective reviews from the media.

If we did, the effect on progress would be traumatic, particularly in the audio-hifi field. It is the hifi public, constantly looking for something better, which supports the designers who have the urge to produce it. Take away the means of mutual motivation and the whole thing would slip into the doldrums.

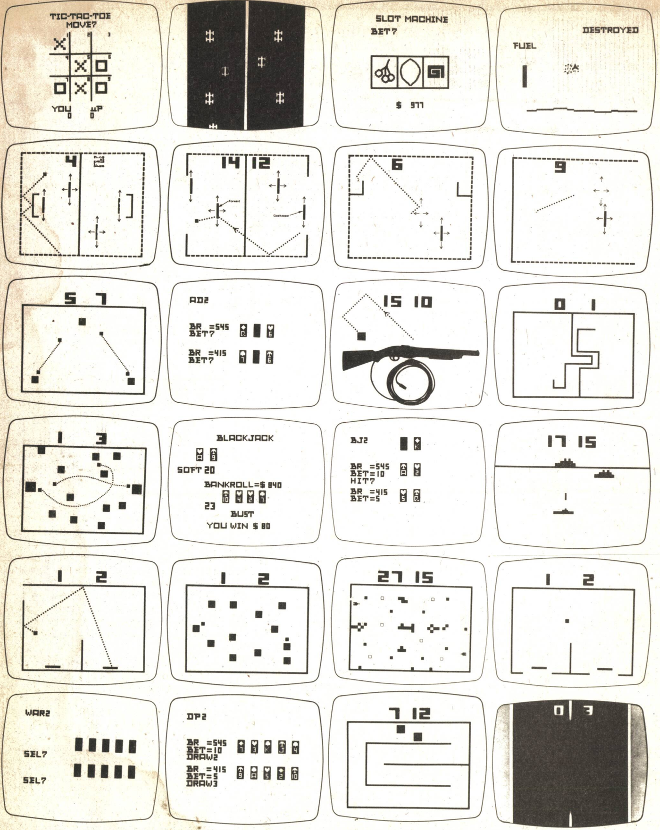
The fact is that Fulton Electronics are advancing a legitimate point of view in their attempt to capture a natural sound. Whether or not R.S.C. agrees with their ideas, their prose and their music, the attempt does come off. The sound is very natural.

Similarly, there is merit in the PCM mastering system, in RCA's Dynagroove, in the specially shaped styli that came out of research into quadraphonics, in various pickup cartridge designs, in the amplifier designs mentioned, and in many of the competitive loudspeakers systems.

Maybe they didn't all deserve quite the level of praise they were accorded; maybe they didn't revolutionise the industry to the extent that their proponents might have hoped but they did make—and are making—valuable contributions to hifi technology.

One might even spare a parting kind word for some highly publicised equipment which conceals quite ordinary technology behind a nicely presented panel and controls. Don't laugh too soon or too loud.

From time to time we are faced with equipment which shows a lot of resource internally, but very little in terms of user presentation. Maybe something does remain to be learned from the glossy model on the next stand, which has to be sold on the basis of: handsome brushed panel; silky smooth controls, positioned and clearly marked for your convenience; styled to bend into any decor . . .



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The Serviceman

Look at the picture carefully

The importance of carefully studying the picture on a faulty TV set, and the information it can provide, is emphasised again this month by a typical case. Also, when you have tracked a fault down to a particular component, take another look before you discard it. It could be quite innocent.

My first story this month concerns a small monochrome TV set, a 12in model made in Australia by a well known local firm. It was almost brand new, and probably still under warranty but, for a number of reasons, the customer found it more convenient to have the job done by a local serviceman, than to send it back to the makers.

The complaint was intermittent loss of horizontal hold. The customer thought it seemed slightly more prone to fail when it was first switched on than when it had warmed up thoroughly, but he wasn't too sure about this. On the other hand he was quite emphatic that it had become progressively worse of late. When first noticed it occurred only every few days; now it was likely to occur several times a day.

Well that was something in its favour. While ever it continued to misbehave I could at least get to grips with it. It is the set which runs for days, sometimes weeks, without a sign of trouble that is the real pain in the neck. Not only are there no symptoms to work with most of the time but, when a likely cause has been found and treated, it is difficult to be sure that this really has cured the trouble.

This one was more obliging; the first time I turned it on it came up without horizontal sync. The first thing I did, almost instinctively, was to tap around the case and give it a few gentle jolts to determine whether it was sensitive to vibration. It didn't seem to be and, on reflection, I imagine the owner had probably already tried the same tactics.

Next I located the horizontal hold control on the back of the cabinet and gave it a twiddle. This seemed to have no effect whatever, which suggested that it was a fairly fundamental fault.

One difficulty concerning this job was that it was not a set with which I was familiar, and the only information I had was a copy of the circuit in a small service manual which the owner provided.

I turned to this now and started to analyse the appropriate part of the circuit. In broad terms it followed normal practice; a phase comparator to which was fed both sync pulses from the sync separator, and reference signals from the horizontal output transformer.

The phase comparator then varied the operating conditions of the horizontal oscillator to pull it back into phase when it tended to drift. The horizontal hold control was a pot which varied the bias on the comparator stage.

"You're troubled with ignition interference?" (Radio-Electronics)

The comparator used two sets of reference pulses from the horizontal output transformer, one positive going and one negative going, taken from two tappings, one each side of a centre tap. In accordance with normal practice the short sharp pulses from the transformer were fed to an RC integrating network which converted them to saw-tooth signals suitable for application to the comparator stage. In this case there were two integrating networks, one producing positive going sawteeth, the other the negative ones.

Other comparator systems often adopt an opposite philosophy; two sets of sync pulses, of opposite polarity, are compared with a single pulse from the line output transformer, this latter pulse again being integrated to produce a sawtooth waveform. I imagine there is not much to choose between the two systems, apart from purely practical advantages.

Having studied the circuit I realised that there was another control that should vary the oscillator frequency; a tapped coil, with variable slug, which formed part of the oscillator circuit.

I removed the back and was confronted by the copper side of a large printed board, something which reminded me that I had no diagram of the wiring pattern or component layout. Finding the right pieces of copper on which to make measurements can be a bit tricky in these circumstances.

However, I did find a coil former with an adjustable slug in it and a rough check seemed to confirm that it was part of the oscillator circuit. By this time the set had come good so I switched it off and let it cool down before trying again. In fact, it took a couple of tries to produce the fault symptom again and I was inclined to question the owner's observations about it being worse when it was cold. Anyway, when it did fail I gave the slug a tentative twiddle and was gratified to see the random pattern on the screen change markedly.

Further twiddling brought it upright and I was able to float the picture through a normal appearance. But there was nary a suggestion of locking; not the slightest hesitation as the picture drifted from one side to the other of normal.

From these symptoms I immediately suspected a complete loss of sync pulses. I reached for the CRO leads and began tracing the copper pattern in a search for these. In fact I soon found them and, as nearly as I could determine without pulling the board out, they appeared to be intact right up to the comparator stage.

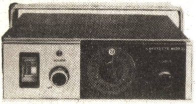
So, if we had sync pulses but no sync, what was the next thing to check? What about the reference pulses from the line output stage? I prodded around with the CRO lead and soon found one nice sawtooth waveform, exactly as shown on the circuit.

But finding the second set was another matter. I traced the copper pattern and checked where I reckoned they should be, but all I could find was a short sharp pulse, virtually identical with that shown as coming from the line output transformer and being fed to the integrating circuit.

At this point I had to admit that I couldn't be sure that I was measuring the right part of the circuit. I had avoided pulling the board out until now, because it looked like a rather nasty job. But I now realised that it would have to be done.

When I finally did get it out and checked the components on the other side I realised that my original measurements had been correct; I should have be able to observe the other

CB . . . *WE'VE GOT IT!*



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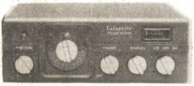

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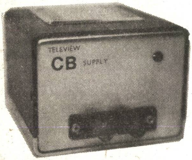

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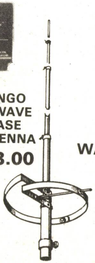

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sawtooth pattern where, in fact, I had found only a spike.

A glance at the circuit suggested that the most likely culprit was the integrating capacitor running from the pulse line to deck. If it was open circuit it would produce exactly these symptoms.

Fortunately, I hesitated before I pulled it out. The set was almost brand new and I felt that the likelihood of the capacitor developing such symptoms so early in its life was remote. Nor was this simply intuition; it was a high quality polyester capacitor which had earned itself a reputation for reliability. It seemed completely out of character that it should go open circuit after such a short period.

On an impulse, I reached for my jeweller's glass and took a close look at the copper side of the board where the pigtails of the capacitor were soldered to the copper pattern. Superficially, the joints looked the same as all the rest; a tiny mountain of solder, with concave sides, flowing up to a peak at the clipped end of the pigtail. To the naked eye they were perfect joints.

Under the glass it was a different story, as far as the earthy side of the capacitor was concerned. At the peak of the mountain, around the pigtail, was a tiny but distinct crater. Was it a dry joint? Any lingering doubts were dispelled when I applied gentle pressure to one side of the pigtail with the test prod. The picture snapped upright and remained rock steady.

After I had repaired the joint I couldn't help speculating as to how this particular fault had occurred. The board had obviously been flow soldered and it wasn't difficult to imagine that a greasy or oxidised pigtail would reject the solder. What really intrigued me was the way in which the solder had flowed. When solder fails to wet a pigtail it usually backs off quite noticeably, becoming almost doughnut shaped. As a result, it is fairly obvious.

But in this case the solder had behaved exactly as if it had wet the pigtail, even though it was clearly shown that it hadn't. Had it wet the pigtail further along its length, on a portion that was subsequently trimmed off? Or does the flow soldering technique, in which the copper pattern faces downwards, allow gravity to produce a typically shaped joint, even when the pigtail rejects the solder?

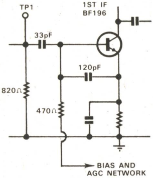
Whatever the answer, and I confess I don't know it, I cannot escape the conviction that, in spite of all the progress we have made in electronics, the soldered joint remains a major weak point in our scheme of things. It is also something of a contradiction. Properly made it is probably the best electrical joint we have. Poorly made it can combine unreliability with deceptiveness—and cost a small fortune to find!

My next story concerns a colour TV set and, as in another recent case (May 1977) my first clue came from careful observation of the picture on the screen.

The set was a HMV "Galaxy", using the "33 Series" circuit. This is a hybrid set; solid state for all the signal processing, but with valves in the deflection circuits. However, this fact had no bearing on the problems.

The complaint was simply loss of colour. A check in the customer's home ruled out such obvious things as maladjusted of fine tuning, etc, and my first reaction was that some part of the chrominance circuit had dropped its bundle. Since such a fault could involve a long search I decided it would be better to take the set back to the shop.

On the bench I turned it on and studied the picture again. Superficially it was a good monochrome picture which one could easily have passed as normal for a set which had lost its colour. But I felt that there was something not quite right about it; something which eluded me at first. Then I realised that the contrast seemed to be lacking; not by much, but enough to make me suspicious.



Failure of this IF stage caused the set to lose colour, but it still gave an acceptable monochrome picture.

Thus alerted I switched to a blank channel and was not really surprised to find that there was little or no snow on the screen. Whatever else was wrong with the set it certainly appeared to be down in sensitivity, with the strong possibility that this was the major fault.

The lack of sensitivity was confirmed by feeding a signal from the pattern generator into the test point (TP1) at the input of the first IF stage. This is a BF196 transistor and feeding the signal directly to its base gave a similar result. However, when I fed the same signal into its collector the sensitivity was much improved.

That seemed to pinpoint the faulty stage and my first reaction was to blame the transistor, the main reason being that I had experienced a previous case where failure of this stage had been caused by a faulty BF196.

So, without further ado, I pulled out the suspect transistor and replaced it—a fairly simple operation as it happens. Unfortunately, this had no effect and I realised that I had been somewhat hasty in blaming the transistor.

The next step was to do what I should have done before; measure the voltages on the transistor. This showed no voltage on either the base or the emitter and the full rail voltage on the collector. Clearly, the transistor was not drawing any current.

In this circuit the transistor base voltage is derived from a voltage divider network across the 12V supply. Part of the network is a 10k pot which is preset to give correct AGC operation and usually delivers about 2.5V to the base, via a 470 ohm resistor.

With no voltage on the base I shifted the meter prod to the other side of the 470 ohm resistor, where I read about 1.5V. Not only was this lower than I expected but, more importantly, was not evident in any degree on the base side of the 470 ohm resistor. Which suggested that the fault was also on this side of the resistor.

This was confirmed when I temporarily disconnected the base end of the resistor and found that the voltage at the other end rose to the expected figure of about 2.5. At this point I decided to remove the replacement transistor, since it was logical to replace the original one. And while the transistor was off the board I took the opportunity to measure the voltage at its base point again—just in case something silly was going on. In fact it was still zero.

There were only two other components connected directly to the base of the transistor; a 120pF from base to emitter and a 33pF coupling capacitor which connected it to the tuner via a network of adjacent channel traps. This line also connects to the chassis via an 820 ohm resistor.

When I lifted one end of the 33pF capacitor the missing 2.5V suddenly reappeared at the base of the transistor. At the same time a resistance measurement between the base end of the capacitor and chassis showed 820 ohms.

As I expected, a resistance measurement straight across the capacitor showed a dead short, but only for about one second. As it happened I had used the low ohms range of the meter and I can only assume that, whatever the nature of the fault, it was cleared by the relatively heavy current available on this range. (Not that I would trust such a repair!)

I fitted a new capacitor, re-fitted the original transistor, and the set came good; excellent contrast and normal colour. Apparently the loss of sensitivity had been sufficient to drop the signal below the colour killer setting, thus switching off the colour. In all probability the colour could have been restored by re-adjusting the colour killer, though this would obviously be the wrong way to cure the problem.

The point about this story is that the clue to the nature of the fault started out as little more than an impression about the appearance of the monochrome image; an intuitive feeling that it was not quite right.

As a well known TV detective used to say, "It was just a hunch; sometimes it pays to play a hunch!"

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Making Mini Scamp bigger and better

Here are the promised details showing you how to expand the basic Mini Scamp microcomputer design into a more powerful one. You can interface it to a teleprinter or a video terminal very easily, and you can also expand its memory to either 1,024 bytes of RAM or 1,280 bytes of mixed RAM and ROM or PROM—all at surprisingly low cost!

by JAMIESON ROWE

In its original form, Dr. Kennewell's Mini Scamp microcomputer is excellent for teaching the fundamentals of microcomputer operation. However once you have learned the fundamentals, it can be a bit frustrating to have to feed your programs in each time via the front panel switches and LEDs. Before long, you will want to add interfacing so that you and your Mini Scamp can talk to each other more conveniently, using a teleprinter or video terminal.

As it happens, you can provide your Mini Scamp with standard 20mA-loop asynchronous serial interfacing very easily, and at low cost. All that is required are two low cost transistors and a handful of other parts, connected to the "Flag-0" and "Sense-B" pins of the SC/MP chip itself (pins 19 and 18 respectively).

The circuit details are shown in Fig. 1. As you can see, the output interfacing from the SC/MP flag pin is simply a BC558 or similar PNP transistor arranged as a switch controlling a 20mA current derived from the +5V line. When the SC/MP flag is at the logic low level, the transistor is turned on and 20mA of current flows out into the teleprinter or terminal. This is the "mark" or idle condition.

If the flag is taken to logic high, the transistor is turned off. The output current to the terminal is thus interrupted, producing the "space" condition. The SC/MP is thus provided with a means of switching the terminal current between the standard mark and space levels, via the level at its flag 0 output.

The input side of the interfacing is equally simple. The keyboard output of the terminal is used to control the conduction of another transistor switch, this time a BC548 or similar NPN device. This is connected in turn between the SC/MP sense-B input and ground, so that it controls the logic level at this input (there is an internal pull-up resistor of around 7.5k, on the SC/MP chip).

The RC circuitry at the input of the transistor is used to suppress contact bounce and any hash which may be picked up by the terminal cable.

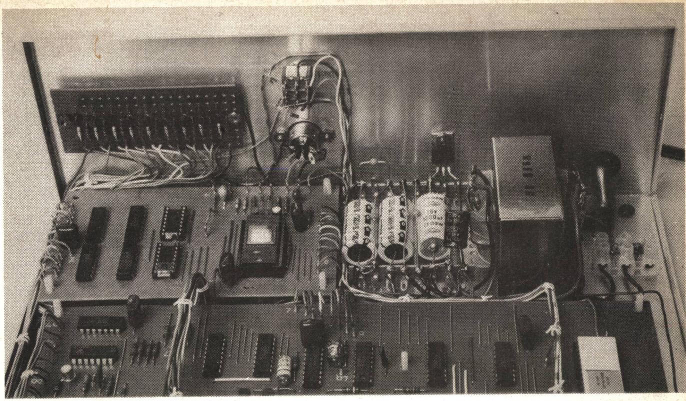
When the keyboard output of the terminal is in the low-impedance "mark" state, it holds the base of the transistor at ground potential. The transistor is thus cut off, and the pullup resistor inside the SC/MP chip pulls the sense-B input up to the logic high level.

If the keyboard output switches to the high impedance "space" state, a forward bias is applied to the transistor base via the divider formed by the 1k, 3.3k and 1k resistors. The transistor thus conducts, pulling the SC/MP sense-B input down to the logic low level.

Hence this simple interface allows a standard teleprinter keyboard or video terminal output to communicate with the SC/MP chip, by controlling the logic level at its sense-B input.

As you can see, the interfacing circuits of Fig. 1 are very basic. They merely provide electrical matching between the SC/MP flag-0 and sense-B pins and a standard 20mA current-loop terminal. There is no special hardware for handling information in asynchronous serial form, or for converting between this form and parallel format. This is all left to the SC/MP itself to take care of, via suitable software "driver" routines.

As well as being very economical, this



The pictures above and on the facing page show the prototype Mini Scamp in expanded form. It now sports a serial terminal interface, a total of 768 bytes of RAM, and a 512-byte ROM with resident monitor.

approach is also a very flexible one. It means that you can change the serial data format very easily, simply by changing the software driver routines. All you need to do to interface Mini Scamp to a terminal with a particular code and data rate is write the appropriate driver routines!

What this means, for example, is that you aren't just limited to using a relatively expensive ASCII-code teleprinter or video terminal. You can use a surplus Baudot-code teleprinter instead, merely by writing a pair of driver routines to suit its 5-bit data format and 50 (or 45) baud data rate.

So that you won't be completely on your own, we are reproducing here listings for a pair of driver routines for talking to a standard 110-baud ASCII teleprinter or video terminal. These should at least give you an idea of what is involved, so that you can write similar routines for other types of terminal.

Both routines are reproduced here by courtesy of National Semiconductor, as they are basically those which come in the "KITBUG" monitor ROM. We have modified them slightly to adapt them for general use in RAM, and deleted the original ROM addresses as these are not relevant.

GECO is the input subroutine, which is called to fetch a character from the terminal and return with it in the SC/MP accumulator. It also echoes the character automatically to the teleprinter or video terminal display screen.

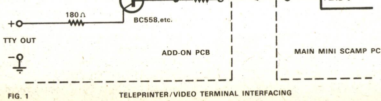


FIG. 1 TELEPRINTER/VIDEO TERMINAL INTERFACING

GECO expects pointer register P2 to have been set up as a pointer to a stack in RAM—i.e., it expects P2 to contain the address of the uppermost of a small stack of "scratchpad" memory locations.

You call GECO using an XPPC P3 instruction (hex code 3F), having first set pointer register P3 to the address of the memory byte immediately before the start of GECO.

As you can see GECO returns to your program by performing a similar XPPC P3 instruction. Because this leaves P3 pointing to its own exit, the "JMP GECO" instruction at the end allows you to call the routine again simply by using another XPPC P3 instruction. (In effect, the start of the subroutine for repeated calling is at the end—this is one of the little tricks with SC/MP.)

The second routine PUTC is to take a character in the accumulator, and send it to the terminal. Like GECO, PUTC is called using an XPPC P3 instruction, but of course P3 must in this case have been set up to the address of the byte immediately before either the first or last instruction of PUTC, rather than those for GECO.

PUTC also expects P2 to be set up as a stack pointer, like GECO. In fact if you use the two routines with a program, it is a good idea to use P2 as the stack pointer for your own program, to avoid hassles. It is often convenient to allocate the very top of the RAM as the stack, so that P2 is set up by loading it with the

```
        ; GECO IS USED FOR KEYBOARD INPUT SO IT ECHOS THE
        ; CHARACTER BUT DOES NOT ENABLE THE READER RELAY.
        ;
C408  GECO:    LDI   8          ; SET COUNT = 8
CAFF           ST    -1(P2)
06    $2:      CSA              ; WAIT FOR START BIT
D420           ANI   020
9CFB           JNZ   $2         ; NOT FOUND
C457           LDI   87         ; DELAY 1/2 BIT TIME
8F04           DLY   4
06             CSA              ; IS START BIT STILL THERE?
D420           ANI   020
9CF2           JNZ   $2         ; NO
06             CSA              ; SEND START BIT (NOTE THAT
DC01           ORI   1          ;   OUTPUT IS INVERTED)
07             CAS
C47E  $LOOP:   LDI   126        ; DELAY 1 BIT TIME
8F08           DLY   8
06             CSA              ; GET BIT (SENSEB)
D420           ANI   020
9802           JZ    $3
C401           LDI   1
CAFE  $3:      ST    -2(P2)     ; SAVE BIT VALUE (0 OR 1)
1F             RRL              ; ROTATE INTO LINK
01             XAE
1D             SRL              ; SHIFT INTO CHARACTER
01             XAE              ; RETURN CHAR TO E
06             CSA              ; ECHO BIT TO OUTPUT
DC01           ORI   1
E2FE           XOR   -2(P2)
07             CAS
BAFF           DLD   -1(P2)     ; DECREMENT BIT COUNT
9CE5           JNZ   $LOOP      ; LOOP UNTIL 0
06             CSA              ; SET STOP BIT
D4FE           ANI   0FE
07             CAS
8F08           DLY   8
40             LDE              ; AC HAS INPUT CHARACTER
D47F           ANI   07F
01             XAE
40             LDE
3F             XPPC  P3         ; RETURN
90C1           JMP   GECO
```

```
      ; 'PUTC'
      ; PUT CHARACTER  IN AC TO TTY.
      ; NOTE: TTY LOGIC LEVELS ARE INVERTED FOR OUTPUT
      ;
01    PUTC:    XAE
C4FF           LDI   255
8F17           DLY   23
06             CSA             ; SET OUTPUT BIT TO LOGIC 0
DC01           ORI   1         ;   FOR START BIT. (NOTE INVERSION)
07             CAS
C409           LDI   9         ; INITIALIZE BIT COUNT
CAFF           ST    -1(P2)
C48A  $1:      LDI   138       ; DELAY 1 BIT TIME
8F08           DLY   8
BAFF           DLD   -1(P2)    ; DECREMENT BIT COUNT.
9810           JZ    $EXIT
40             LDE             ; PREPARE NEXT BIT
D401           ANI   1
CAFE           ST    -2(P2)
01             XAE             ; SHIF DATA RIGHT 1 BIT
1C             SR
01             XAE
06             CSA             ; SET UP OUTPUT BIT
DC01           ORI   1
E2FE           XOR   -2(P2)
07             CAS             ; PUT BIT TO TTY
90E8           JMP   $1
06    $EXIT:   CSA             ; SET STOP BIT
D4FE           ANI   0FE
07             CAS
3F             XPPC  P3        ; RETURN
90D4           JMP   PUTC
```

Here are two utility driver routines, designed to service a 110-baud ASCII teleprinter or video terminal. Both assume that the SC/MP clock oscillator is running at 1MHz, so that if you aren't using a crystal you may need to "tweak" the clock capacitor.

address of the top of your RAM area.

And talking about RAMs leads us on to the next area of interest when it comes to expanding Mini Scamp.

Although the 256 bytes of memory provided in the basic Mini Scamp are enough to let you work on quite respectable machine-language programs, the odds are that it won't take long before you'll be wanting to expand the memory to run larger programs. This seems to happen with almost everybody.

As we noted last month, it is quite easy to expand Mini Scamp's memory up to quite a respectable level. In fact if you want to simply provide additional RAM, it is merely a matter of connecting additional pairs of 2112 memory chips up to the address and data buslines, the write strobe line and the appropriate outputs of the 74LS138 address decoder.

You can add up to three additional pairs of RAM chips in this simple way, without exceeding the loading capability of the SC/MP chip. This will give you a total of 1,024 bytes of RAM, or "1k", which should be more than adequate for any machine language program you're likely to write for quite a while.

The basic connections required for this sort of simple RAM expansion are shown in Fig. 2. As you can see, the existing RAMs on the main Mini Scamp PCB remain as the lowest 256 bytes, gated by the 0 output of the decoder as before. The additional pairs are gated by the next three decoder outputs, so that the four pairs provide a continuous range of addresses from 000 to 3FF hexadecimal.

Note that you can't expand to beyond Ik of RAM using this approach, because any further RAM pairs would exceed the SC/MP loading capacity. More about this later . . .

Naturally enough some readers may like to provide their Mini Scamp with the ability to run a program in ROM or PROM memory. For example, you may have an MM5214 ROM with the "Kitbug" monitor program, as supplied with the National Semiconductor SC/MP kit.

Although Kitbug is a fairly basic little monitor program, it does include the terminal driver subroutines–so that your programs can simply call them as required. It also has another subroutine

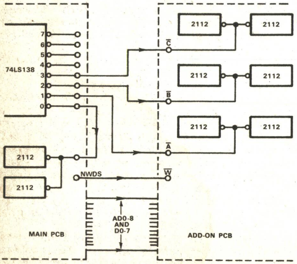


FIG. 2 DECODING FOR RAM-ONLY SYSTEM — TOTAL OF 1k (000-3FF)

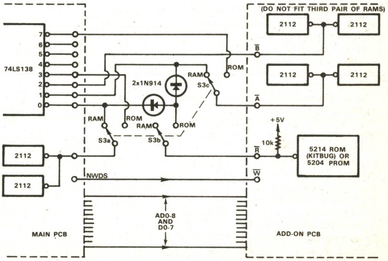
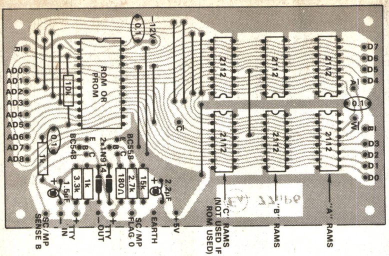
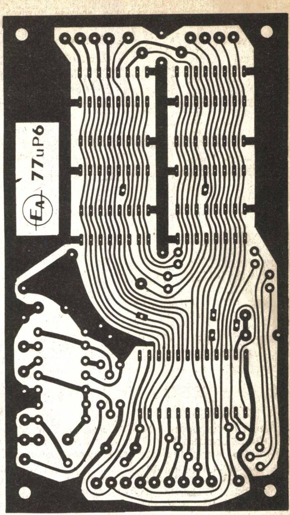


FIG. 3 DECODING FOR RAM AND ROM/PROM SYSTEM (768 BYTES RAM, 512 BYTES ROM)
WHEN ROM IS INACTIVE RAMS OCCUPY 000-2FF
WHEN ROM IS ACTIVE ROM OCCUPIES 000-1FF, RAMS OCCUPY 200-3FF, 700-7FF





At right is the PCB pattern for our add-on memory and interfacing board, shown actual size. The diagram above shows how to wire it up for both RAM and ROM, but note that only two extra pairs of RAMs can be used if you fit a ROM or PROM as well.

which can be used to print out 8-bit numbers in hexadecimal, called PHEX. This is also handy.

And in addition Kitbug provides you with some basic monitor-debug functions, so that you can feed in programs from the terminal keyboard, examine and modify them, and run them. So that it can be very convenient to have Kitbug resident in your Mini Scamp, in a ROM, so that it knows how to do these things right from switch-on.

It is fairly easy to add an MM5214 ROM or an MM5204 UV-erasable PROM to the Mini Scamp, with up to a total of 768 bytes of RAM (i.e., ¾k) as well if desired. The basic circuit is shown in Fig. 3.

As you can see some address switching is required, because SC/MP programs normally start at the bottom of memory space. Hence to run the ROM program it must be switched down in place of the existing RAM.

Although this could be done with fixed wiring, it would then not be possible to run programs in RAM under control of the front-panel switches. They could only be run under the control of the ROM monitor, using a terminal.

By using switching as shown, you are able to disable the ROM at will, and swing RAMs down into the lowest part of memory space to allow programs to be run in RAM via the front panel.

The reason for the diodes is that a 5214 ROM or a 5204 PROM is 512 bytes, so that it occupies two 256-byte memory blocks. When active it must therefore be enabled by both the 0 and 1 outputs of the 74LS138. The diodes achieve this by allowing the R-bar line to be pulled low by either decoder output.

Switch pole S3a is used to swing the original pair of RAMs up to the 300-3FF block of memory space when the ROM is in use. Similarly switch section S3c is used to swing the "A" pair of additional RAMs out of the 100-1FF block, as this is also occupied by the ROM.

Note that Fig. 3 shows the A-bar line as being switched to the "7" output of the decoder in the ROM position, so that the "A" RAMs are swung up to the 700-7FF block of memory space. This is strictly only necessary for the Kitbug ROM, which expects its RAM stack to be at the top of the current memory page.

If you are using some other ROM or PROM, you could elect to switch the "A" pair of RAMs to some other block of memory space by using one of the other decoder outputs instead. If you were to use the "4" output, for example, they would occupy the range 400-4FF when the ROM is active.

When you are using a ROM or PROM, you can only use the simple expansion technique of Fig. 3 to expand the RAM part of the system to a total of 768 bytes—¾k. This is true even when the ROM or PROM is switched out of operation using S3.

The limitation is again one of SC/MP loading, on the data and address lines.

You could of course fit sockets in the "C" RAM positions, and also in the ROM/PROM position. This would allow you to unplug the ROM or PROM when it was not in use, and plug in the third pair of additional RAMs instead. While slightly messy, this would be fairly practical if you took care in handling the devices.

Even without this trick you can still have a system with up to 1280 bytes of memory—768 bytes of RAM, and 512 bytes of ROM/PROM. This is quite a respectable memory.

To help you in expanding your Mini Scamp along the lines we have discussed so far, we have produced a small add-on PC board pattern. Coded 77uP6, the PCB measures only 130 × 75mm. However it lets you provide both the terminal interfacing of Fig. 1 and either the RAM-only expansion of Fig. 2, or the mixed RAM-ROM system of Fig. 3.

We are reproducing here the PCB pattern, actual size, for those who may wish to make their own boards. However, boards made to the pattern should be available from the usual suppliers shortly.

The wiring of the PCB is as shown in the overlay diagram. As you can see, it is fairly straightforward.

If you are planning to use the Kitbug ROM, however, there are a couple of modifications which you will have to make to the main Mini Scamp PC board. These are necessary because Kitbug uses page wrap-around addressing to establish its stack in RAM. This means that it addresses the stack as if its top location were at hex FFF—a "non-existent" memory location even on the original SC/MP kit.

The writers of Kitbug were able to take this liberty because of the simplified addressing circuitry on the original SC/MP kit. In effect, the one pair of

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.039, .047, .056, .068, .082, .1, .12,	.16
.15, .18, .22,	.16
250V	
.27, .33, .39, .47, .56,	.36
.68, .82,	.55
630V	
.001, .0015, .0022, .0033, .0039, .0047,	.13
.0056, .0068, .0082, .01, .015, .022, .033,	.17
.047, .1,	.22

CERAMICS 630V

10	100	1n0	33	330	3n3	.07
12	120	1n2	39	390	3n9	.07
15	150	1n5	47	470	4n7	.07
18	180	1n8	56	560	5n6	.07
22	220	2n2	68	680	6n8	.07
27	270	2n7	82	820	8n2	.07

ELECTROLYTIC CAPACITORS

	25V	50V
2.2, 3.3, 4.7,	.11	.11
10, 22, 33,	.13	.15
47, 100,	.18	.22
220, 330, 470,	.45	.57
1000,	.55	1.10

TAG TANTALUM

.1, .22, .47, .68, 2.2, 3.3, 4.7,	35V	.25
6.8, 10,	25V	.25
15,	16V	.25
22, 33,	10V	.25
47,	6V	.25
100,	3V	.25

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2500,	35V	1.15

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5-60 pF	.55

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900	6mm slug to 60MHz	.10
901	6mm slug to 200MHz	.10
910	6mm slug to 300MHz	.10

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6PLB	722 base	.13
7100	722/1 can	:16
7101	722/4 can	.16
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SS1	minature slide, DPDT	.23
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MT1	minature toggle, SPDT	1.45
MT2	minature toggle, DPDT	1.95
MP1	minature push, momentary	.35

ROTARY SWITCHES

142	4 pole, 2 position	1.20
143	4 pole, 3 position	1.20
134	3 pole, 4 position	1.20
125	2 pole. 5 position	1.20
1112	1 pole, 12 position	1.20
2 Section		
234	6 pole, 4 position	2.20
225	4 pole, 5 position	2.20
2112	2 pole, 12 position	2.20
3 Section		
334	9 pole, 4 position	3.20
325	6 pole, 5 position	3.20

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WT1	slide pot knob	.33
195	silver HIFI knob	.95
195A	small silver HIFI knob	.85
245	silver instument knob	.90
859	small black knob	.40
857	large black knob	.50
4094	coloured push, rect.	.50
4354	coloured push, round	.50
4093	black minature push	.45

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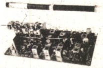

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RAMs occupied a number of different blocks in memory space—including both the 200-2FF block and the F00-FFF block.

To allow Kitbug to operate correctly with Mini Scamp, it is necessary to pull a similar trick. In fact the easiest way is to disconnect address line AD11 from the 74LS138 decoder, so that it can no longer distinguish between the first and second 2k blocks of memory. This then allows the "A" RAMs, connected to the 7 output of the decoder, to act as if they are in memory block F00-FFF as well as block 700-7FF.

Of course the other memory blocks become duplicated too, so that the original RAMs will occupy B00-BFF as well as 300-3FF, and the "B" RAMs will occupy A00-AFF as well as 200-2FF. The ROM will also occupy 800-9FF as well as 000-1FF. But these addressing ambiguities will not cause problems, because there are no other devices at the duplicated memory blocks.

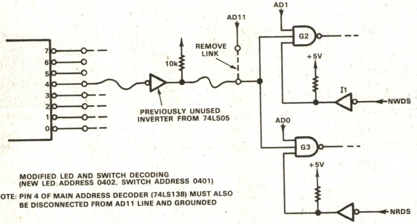
To make this modification, you will have to cut the copper track of the AD11 address line, either side of pin 4 of the 74LS138 decoder. Pin 4 of the IC can then be grounded, by linking it across to pin 5. Another insulated link should then be used to rejoin the two severed halves of the AD11 line to each other.

Even with this modification there is still a further complication if you want to use the Kitbug ROM. The simple addressing used in Mini Scamp for the front panel LEDs and switches is no longer adequate, because it clashes with that of Kitbug itself.

In other words, it is necessary to change the addressing of the LEDs and switches. The easiest way of doing this is shown in Fig. 4.

As you can see, it involves removing the original link used to gate G2 and G3 from the AD11 line, and using one of the originally "spare" 74LS05 inverters to gate them instead from the unused "4" output of the 74LS138 decoder.

This is fairly easily done, and involves only an extra 10k resistor and two short lengths of hookup wire.



MODIFIED LED AND SWITCH DECODING (NEW LED ADDRESS 0402, SWITCH ADDRESS 0401)

NOTE: PIN 4 OF MAIN ADDRESS DECODER (74LS138) MUST ALSO BE DISCONNECTED FROM AD11 LINE AND GROUNDED

FIG. 4 MODIFICATIONS FOR KITBUG ROM

Note that with this modification done, the front panel LEDs will now have the hex address 402, instead of the original address 802. Similarly the switches will now have the address 401 instead of 801.

If you don't remember this, you may find that programs written for Mini Scamp in its original form won't work! I found this out the hard way, myself. For example with both of Dr. Kennewell's sample programs given in the original Mini Scamp article, you will need to change the first real instruction to LDI 04 (hex code C404), before they will work.

Well, that's the story on how to expand your Mini Scamp easily into quite a respectable little machine. Perhaps there's only one more question to answer: is it possible to expand the system still further?

The answer to this is yes, but with qualifications. To add further memory, you will need to use a more thoroughgoing approach. The address lines will need to be buffered, while the data lines will have to be provided with bidirectional bus transceivers. Similarly the address decoding will need to be extended, to provide decoding for more blocks of memory.

It will probably also be necessary to buffer the Write strobe line (NWDS), at least. And of course you will need a suitable PC board to mount the additional memory devices, so there will be the business of mounting all of this additional circuitry in the Mini Scamp case.

While you could probably do all this, you would really be stretching the Mini Scamp concept beyond its normal bounds. The end result would start to become a mechanical monster, and rather hard to troubleshoot if anything goes wrong.

If you really do want to expand to a big system, the best plan might be to change over to a modular system rather than attempt to enlarge the Mini Scamp concept still further.

Most of the parts you have used in Mini Scamp should be suitable for use in a modular system, so that with a little care you should be able to make the change at relatively low cost.

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CA3060	8.40	CD4043	2.25	LH0070	6.20	LM566CN	2.50	SD306DE	1.50	74C04	.55
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CD4002	.55	CD4078	.55	LM320T	4.50	LM1488N	6.90	SL641C	10.60	GL5253	.90
CD4006	2.30	CD4081	.55	LM322N	4.50	LM1489N	5.75	SL645C	12.60	OL31	.90
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CD4008	2.35	CD4085	1.65	LM324N	4.50	LM1808N	3.90	SL917B	6,50	RL5023	.35
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7411	.54	74100	3.65	74LS09	.55	**SEMICONDS**		MFE131	1.95	2N4250	.65
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7416	1.00	74122	1.20	74LS13	1.20	AC127	1.80	MJ4502	8.90	2N4360	.95
7417	1.15	74123	1.40	74LS14	2.95	AC128	1.80	MPF102	.65	2N5245	.75
7420	.48	74132	1.90	74LS20	.55	AC132	1.50	MPF103	.85	2N5457	MPF103
7422	1.95	74141	2.75	74LS21	.55	AC187	1.50	MPF104	1.10	2N5458	MPF104
7425	.95	74145	2.95	74LS22		AC188	1.50	MPF105	.65	2N5459	MPF105
7426	.70	74150	3.25	74LS27	.60	AD149	2.60	MPF106	1.15	2N5485	MPF106
7427	.66	74151	2.20	74LS28	.60	AD161/62	4.50	MPF121	1.60	2N5590	MRF603
7430	.48	74153	1.95	74LS30	.55	AS322	.18	MPF603	6.90	2N5591	11.30
7432	.66	74154	3.20	74LS32	.70	AT1138	2N301	TIP31C	1.20	2N6027	1.35
7437	.90	74157	2.20	74LS37	.70	ASY17	2.65	TIP32C	1.30	2N6084	21.00
7438	.90	74160	2.75	74LS38	.70	BC107	.35	TIP120	3.20	2SC799	5.50
7440	.48	74164	2.90	74LS40	.65	BC108	.35	TIP125	3.30	2SC1306	5.50
7441	2.80	74165	2.90	74LS42	2.20	BC109	.35	TIP141	4.70	2SC1307	5.50
7442	2.60	74174	2.90	74LS73	.75	BC177	.40	TIP2955	1.70	BA102	.80
7445	2.60	74180	2.90	74LS74	.90	BC178	.40	TIP3055	1.70	OA47	.60
7446	2.60	74181	5.95	74LS75	1.20	BC179	.40	TT800	2N4037	OA90	.35
7447	2.60	74185	4.90	74LS78	.75	BC182	.40	TT801	1.20	OA91	.35
7448	2.60	74190	3.20	74LS86	.95	BC212	.50	2N301	2N2869	5082-2800	3.20
7450	.48	74177	2.90	74LS90	1.95	BC327	.55	2N706A	1.20	40440	2N3731
7451	.48	74191	2.90	74LS92	1.95	BC337	.55	2N918	1.60	40637A	2.85
7453	.48	74192	2.75	74LS93	1.95	BC547	.55	2N2222A	1.20	40673	1.95
7454	.48	74193	2.75	74LS95	2.60	BC548	.55	2N2646	2.50	40822	2.90
7460	.48	74194	2.50	74LS109	.85	BC549C	.55	2N2869	2.70	40841	1.90
7470	.85	74195	1.90	74LS113	.85	BC559	.55	2N2904A	1.50	BZX61	.75
7472	.75	74196	2.90	74LS114	.85	BC639	1.20	2N2905	1.20	BZX79	42
7473	.80	74S00	1.50	74LS151	2.60	BC640	1.20	2N3053	1.20	BZX70	1.50
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7475	1.35	74S20	1.75	74LS157	2.40	BD132	1.60	2N3055	1.35	BZY91	12.50
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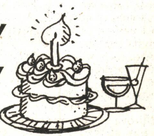

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This month: complementary devices for low noise preamps

Op-Amps without tears-7

Having looked last month at audio power output devices, the author progresses this month to look at the complementary devices which have been developed for application in low noise preamplifiers. He gives some useful circuits for tape head and magnetic cartridge preamps.

by J. BRIAN DANCE, M.SC

Standard operational amplifier devices can be used as audio preamplifiers; indeed, we have already described such a circuit in part 3 (Fig. 16) using a 741. However, the low level signals provided by magnetic tape relay heads, high quality record player cartridges, etc., require amplifiers which produce less noise than a standard operational amplifier if one is to obtain the maximum signal to noise ratio.

A number of low noise amplifiers especially designed for audio and other applications are available. They have the advantage over standard operational amplifiers in terms of lower noise and better rejection of any hum on the power supply lines. Their bandwidth and gain are also usually greater than those of a standard device. In most cases the manufacturers have incorporated two low noise amplifiers in a single package so that the one device can be used to amplify both the channels of a stereo system.

LM381N

The National Semiconductor LM381N device is one of the best known dual low noise operational amplifiers. It has an open loop gain of over 100dB and a power bandwidth of 75kHz at the 20V peak-to-peak output level. An internal frequency compensating capacitor provides stable operation with voltage gains of 10 or more, but an additional external capacitor should be used at lower values of gain. The LM381AN is a special version of the LM381N for use when the lowest possible noise level is required, such as for amplifying the signals from hydrophones or in studio tape recorders, etc.

A typical tape playback amplifier using the LM381N is shown in Fig. 46. The tape head provides an output of rather less than 1mV at 1kHz and this is amplified to a level of about 0.5V R.M.S. at the output. The feedback network provides the standard NAB (National Association of Broadcasters) response; the gain falls with increasing frequency by about 30dB between 50Hz and 3kHz. High frequencies pass more easily through C3 in the feedback network than low frequencies and therefore the amount of negative feedback increases with frequency, whilst the gain decreases. Only one channel is shown, the other channel employing a similar circuit.

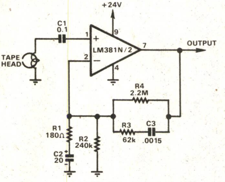

FIG. 46

RECORDING PREAMPLIFIER

A tape recording preamplifier using the LM381N is shown in Fig. 47. The resistors R4 and R1 set the bias working point, R2 and C2 set the mid-band gain, while C3 and R3 set the high frequency roll off point. L1 and C4 resonate at the bias frequency and form a bias trap to prevent the high frequency bias from entering the amplifier circuit.

MAGNETIC CARTRIDGE CIRCUIT

Crystal and ceramic cartridges provide output signals of amplitude somewhere between 100mV and 2V, and no preamplifier is usually required (see Fig. 40, part 6). However, magnetic cartridges produce outputs of only a few mV and a preamplifier is essential. The preamplifier must not only provide the required gain, but must also have the normal RIAA (Record Industry Association of America) playback equalisation characteristic.

A complete preamplifier with tone control for use with a magnetic cartridge is shown in Fig. 48. The capacitors C3 and C4 in the LM381N feedback circuit provide the RIAA characteristic, whilst the output from the device feeds the tone control network shown.

THE LM387N

The LM387N has an internal circuit similar to that of the LM381N, but is encapsulated in the smaller 8 pin dual-in-line case as opposed to the 14 pin dual-in-line package of the LM381N. Fewer connecting pins are available in the LM387N and it can be used only with a differential input stage, whereas the LM381N can be used with its input stage operating in a single-ended mode for minimum noise or in a differential mode. The two transistors of a differential input stage both contribute to the noise. In addition, the LM387N does not have con-

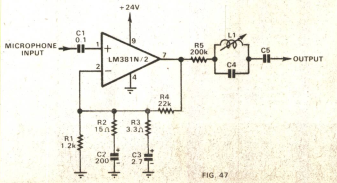

FIG. 47

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nections for an external capacitor which may be required when the gain is less than 10.

THE LM382N

The LM382N is another device like the LM381N, but the LM382N has internal resistors connected so that the number of external components required in tape and record player amplifiers is reduced. It is encapsulated in a 14 pin dual-in-line package, but no facilities are provided for single ended operation or for additional frequency compensation at low values of gain.

A simple circuit using the LM382N as a tape replay preamplifier is shown in Fig. 49; it may be compared with the slightly more complex circuit of Fig. 46 using the LM381N.

An LM382N amplifier for use with a magnetic cartridge is shown in Fig. 50. It provides RIAA equalisation and may be compared with the portion of Fig. 48 on the left hand side of C5. The output from Fig. 49 or from Fig. 50 may be fed via a capacitor to a similar tone control circuit to that shown in Fig. 48.

The LM381N, LM382N and LM387N have a hum rejection quoted as 110 to 120dB. This is a very high value and is a valuable feature in low noise, low level circuits.

THE MC1339P

The Motorola MC1339P is another dual stereo preamplifier, which has a built-in 7.5V regulator and emitter follower outputs. It has a 16V maximum power supply rating as opposed to the 40V ratings of the National Semiconductor devices.

A simple magnetic cartridge preamplifier using the MC1339P is shown in Fig. 51. RIAA equalisation is, of course, provided. Tape replay and recording amplifiers have also been published using this device.

Motorola also offer their earlier MC1303L dual stereo preamplifier device.

THE *u*A739 and TBA231

The Fairchild *u*A739 is equivalent to the SGS-ATES TBA231 dual low noise operational amplifier. These 14 pin dual-in-line devices require external frequency compensation and can be used in the same type of circuits as those already discussed, but a few more external components are generally required.

The Fairchild *u*A749 is similar to the *u*A739, but has an 'uncommitted' collector output. That is, the collector of the output stage is connected only to the output pin, whereas in the *u*A739 there is an internal 5 kilohm collector load resistor.

THE ZN424

The ZN424 is a relatively new device from Ferranti which is available in 14 pin and 8 pin dual-in-line packages as well as in a circular metal TO-39 package. It is a development of the earlier ZN402 device. Both are operational amplifiers, but unlike the devices discussed previously only one amplifier is incorporated into each package. The ZN424 has a gating facility which disconnects the output from the input when the gating connection is grounded. This gating facility makes multiple operation possible; that is, the device may be used as a switch so that several signals can be successively transmitted along a single channel.

The ZN424 employs a Class A output stage for minimum distortion and produces extremely low noise. A simple, high performance non-inverting amplifier with a gain of 100 is shown in Fig. 52. The cut off frequency is about 2MHz and the slew rate about 20V/us, whilst the input impedance is about 10 megohms in parallel with 2pF. The total harmonic distortion at 1kHz and 12V peak-to-peak output is typically 0.1%.

OPERATIONAL AMPLIFIERS

In this series we have discussed a wide variety of applications for operational amplifiers, but strangely enough no analog circuits for carrying out mathematical operations have been included. The reason for this is that it is felt that such circuits are not likely to be of great interest to constructors, although one must remember that such circuits gave the name "operational amplifier" to the devices we now know so well.

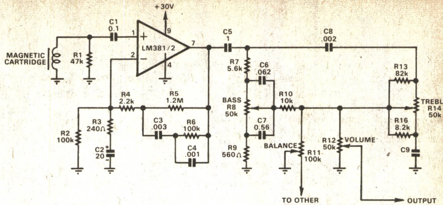

FIG. 48

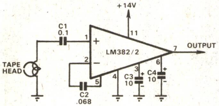

FIG. 49

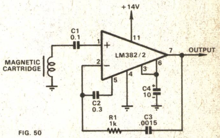

FIG. 50

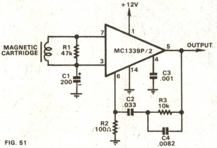

FIG. 51

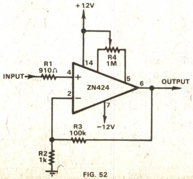

FIG. 52

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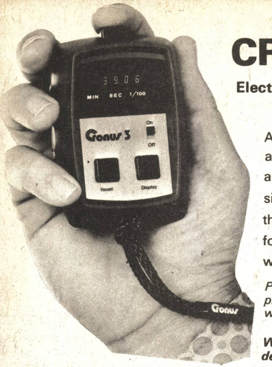

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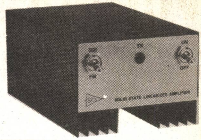

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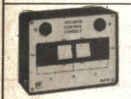

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Switches	Rocker Type
Current Rating	5 amps (150 Watts RMS)
Headphone Outlets	¼'' Stereo Jack sockets
Loading	Using 8 ohm speakers the impedance never falls below 4 ohm.
Termination	Screw Terminal. (Wire entry through underside of box).
Mounting	Surface or Flush. (Screws supplied).
Wiring	Independent earth.
Functions	16 combinations of pairs of speakers. All speakers can be turned off without damaging the amplifier

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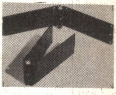

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Voltage regulator for battery equipment

This article describes a novel voltage regulator circuit for use in micro power applications. The design is based on a JFET transistor in conjunction with a single integrated circuit, and features a line regulation within ±0.5% for a range of Vin—Vout of 0.3—10V. Load regulation is 0.2% for loads ranging from 10uA—10mA, while quiescent current is just 4uA approx.

by JOHN MAXWELL*

Many systems require a stable voltage supply to maintain constant performance. When these systems are battery-operated a regulator is needed to stabilize the system voltage as the battery decays with time. Unfortunately, IC voltage regulators require several milliamps of quiescent current, making them impractical for micro-power applications.

Zener diodes may also be impractical because of the short-term peak current requirements of the system. This could require additional buffering or high standby currents, both of which increase the battery drain. An inexpensive micropower voltage regulator is therefore needed to fill the gap between IC regulators (high quiescent current) and zener diodes (high standby current).

Instead of the traditional bipolar approach, the regulator shown in Fig. 1 uses a JFET as the series pass element. This offers several advantages; first, no pre-regulation is needed for the pass element as with an NPN transistor because the drive comes from the regulated output. Next the gate-source is isolated from the line via the drain, thus offering excellent line regulation. This is not the case with PNP pass elements, where the emitter is the input

Finally, FETs require no current drive, an important feature for micropower regulators.

The emitter-base breakdown voltage of Q_3 is used as a reference (≈7.2V) in conjunction with Q_2 to form a shunt regulator. The shunt current drives a current mirror, Q_4-Q_5, which creates the gate drive voltage of the pass FET. The value of the shunt current is determined by R_3 and the V_{gs} of the pass FET ($I_{R3} \approx I_{shunt}$). High load currents will reduce the shunt current because the FET V_{gs} is lower.

Temperature stability is achieved by cancelling the drift of Q_2 and Q_3's V_{be} ($\approx -2mV/°C$/transistor) with the BV_{eb} drift of Q_3 ($\approx +3mV/°C$), resulting in a negative drift at the base of Q_2, and the output, of 1mV/°C.

Selection of the FET requires some care. Ideally, the FET I_{dss} needs to be greater than the load current at all temperatures (I_{dss} has a temperature coefficient of ≈–.7%/°c), and the breakdown voltage should be greater than the maximum input voltage. Practically, the FET I_{dss} needs to be much larger than the maximum load current.

Linear operation requires that the FET's drain to gate voltage (V_{dg}) be greater than the pinchoff voltage Vp. By operating the FET at currents much less than I_{dss}, the gate to source voltage (V_{gs}) will be close to Vp since $V_{gs} = Vp\ (1-(I_d/I_{dss})^{1/2}))$, allowing small drain to source voltages (V_{ds}).

For linear operation the absolute value of V_{dg} is greater than the absolute value of Vp, and $V_{dg} = V_{ds} - V_{gs}$.

It should be noted that N FET's can be paralleled for higher load current requirements without matching the devices.

Actual performance of the regulator is quite good. With a 10V nominal output the line regulation is within ±0.05% for a range of Vin–Vout of 0.3–10V. The load regulation is 0.2% with a load range of 10uA–10mA (Zo ≈10 ohms) and the temperature stability is –0.01%/°C (–1mV/°C).

The output voltage can be easily trimmed by adding a pot at the R_1 R_2 Q_{2base} junction to eliminate BV_{EB} variations or to make the output adjustable over a limited range. Also the temperature stability can be improved by replacing Q_3 with an 8.2V zener diode, because its temperature drift (≈ + 4mV/°C) would nearly match the combined V_{be} drift of Q_2 and Q_4. The regulator is good enough to be used as a reference in low accuracy (6-7 bit) or limited temperature range applications if current drain is important.

REFERENCES

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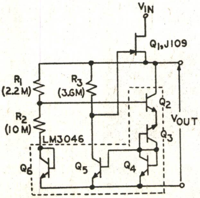
2. "Zener Diode Handbook", Motorola, Inc., May 1967.
3. Williams, P. "D.C. Voltage-Reference Circuits with Minimum Input-Output Differentials" Proc. IEEE pp. 1280-1281, December 1969.



OUTPUT VOLTAGE

$$V_{OUT} = V_{DE}(2 + R_1/R_2) + DV_{ED}(1 + R_1/R_2)$$

DRIFT

$$\frac{\partial V_{OUT}}{\partial T} = \frac{\partial V_{DE}}{\partial T}(2 + R_1/R_2) + \frac{\partial DV_{ED}}{\partial T}(1 + R_1/R_2)$$

QUIESCENT CURRENT ≃ 4μA

Fig. 1. Main components in the low power regulator are the J109 JFET as the series element and LM3406 IC containing Q2, Q3, Q4, Q5 and Q6.

---

* Senior Engineer, National Semiconductor Corporation.

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AK635
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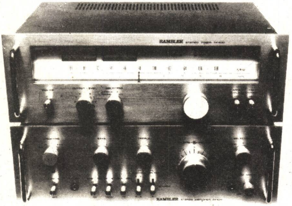

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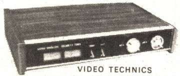

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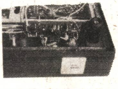

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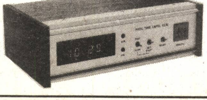

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Microcomputer News & Products

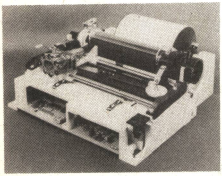
Intel get 3 minutes of music from 2k PROM

Visitors to a recent seminar in Newcastle organised by Warburton Franki, the new Intel Agent and Distributor, were treated to the first performance in Australia of a Bach fugue scored for two Intel 8708 PROMS.

One of the 1k x 8bit memories held the various functions necessary to generate the notes while the other accessed them. The fugue was played on a Prompt 80 development system in full stereo. The performance lasted for a full three minutes, although a continuous encore mode was available.

According to Col Edwards, the Intel Microcomputer Customer Training Manager, Intel spent 3 man-years developing the programs. It seems unlikely then that the popular cassette and record are to be overtaken just yet!

New Philips printer



A new alphanumeric printer unit which runs from a single 12V DC supply has been released by Philips Electronic Components and Materials. Called the 115DR, the new printer operates at up to 66 characters per second and will print lines of up to 40 characters wide on either paper rolls or cards up to 115mm wide.

The 115DR is a mosaic printer, and uses standard typewriter ribbon. It is capable of printing any character which can be formed within a 5 x 7 matrix. In addition, it can be used for facsimile reproduction by driving the printer head in appropriate fashion.

The single 12V power supply, low profile (100mm) and light weight (3kg) make the 115DR suitable for mobile data and communication terminal use as well as for fixed applications. In fact Philips are understandably confident that the 115DR will find application in a very wide range of areas, including data terminals, instrumentation, point-of-sale terminals, police communications, doctors and ambulances.

The features of the 115DR should also make it of interest to computer hobbyists. With a single 12V supply requirement and the ability to reproduce graphics as well as alphanumeric characters, it would make a very attractive terminal for a hobby computer system.

One-off price of the 115DR printer is $338.39 plus tax if applicable. For this you get the printer with head and ribbon system, paper roller and feed mechanism, and motor control electronics. Character generation and solenoid driver electronics are not supplied.

NS release Super-PACE

National Semiconductor in the US has just released a low cost high speed 16-bit microcomputer-on-a-board which uses an expanded version of the instruction set used by their P-channel PACE microprocessor. Called "Super-PACE", the new microcomputer uses high speed Schottky TTL devices to achieve an instruction cycle time of 1us average, in a system which uses the same architecture and is software compatible with PACE.

The Super-PACE CPU board measures 8.5 by 11 inches and incorporates 80 MSI chips. It is supported by RAM boards, ROM and PROM board, an I/O board and software packages.

Further details from NS Electronics, P.O. Box 89, Bayswater, Vic. 3153.

Computers in schools

As part of an innovation project supported by the Schools Commission, Essendon Grammar School in Victoria is producing a series of regular newsletters designed to promote and assist the use of computers in secondary schools. Called COM-3, the newsletter is being edited by Timothy Mowchanuk and Greg Johnstone. Subscription cost is $3 for six issues.

The first issue of COM-3 has articles on hardware and software, listings of game programs, and general news items. The printing is not wonderful, but the editors explain that there were problems which have now been overcome. Later issues should be much more presentable.

Subscriptions should be sent to the editors at P.O. Box 138, Essendon 3040.

Sydney micro club

The Microcomputer Enthusiast Group or "MEGS" meets on the first and third Mondays of the month at the WIA centre, 14 Atchison Street North Sydney. Although formed only a few months ago, the group is already running member training courses on both hardware and software, and publishing a monthly newsletter. It has also set up committees to look into such matters as hardware compatibility.

The group has received welcome support from local suppliers, At the time of writing this, two suppliers had donated microcomputer evaluation kits, while other firms have sent applications engineers to offer literature and advice.

At the invitation of MEGs, EA editor Jim Rowe went to their meeting on April 18th. Also present that evening were NS engineers Ed Schoell and Chris Mason, who demonstrated some of their firm's PACE and SC/MP systems. There was a good attendance at the meeting, with some 60 or 70 keen enthusiasts present.

One of the points raised at the meeting was the desirability of finding agreement on a standard PCB module for bus line oriented personal computer systems.

EA editor Jim Rowe took the Mini Scamp computer and EA video terminal to the meeting, and these seemed to produce quite a bit of interest from members.

Membership inquiries to: MEGS, c/o Post Office, St. Leonards 2065.

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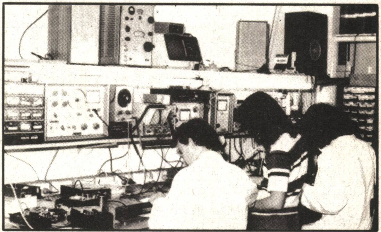

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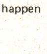

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Classical Recordings

Reviewed by Julian Russell

Richter plays Schumann—"disappointing"

SCHUMANN—Piano Concerto in A Minor. Svjatoslav Richter (piano) with the National Philharmonic Orchestra of Warsaw conducted by Witold Rowicki.

Introduction and Allegro Appasionato in G Major. Richter and the same orchestra conducted by Stanislaw Wislocki.

Novelette in F major and Toccato in C Major, piano solos by Richter. DGG Resonance Stereo 2535 181.

Richter can, with safety, be recognised as the finest living exponent of Schumann's piano music. He recognises Schumann's impetuosity without ever making it sound extravagant. His touch can be enchantingly lyrical or clamourously vehement.

It was because I was expecting to hear all these virtues in the A Minor Concerto that I found some dissappointment. Here he is certainly not at his best, indeed there is more than a hint that he is having an off day. And he doesn't seem to be doing much about it.

Of course he couldn't play the concerto badly if he tried, but he often sounds in a strangely remote mood in this performance. The rather dry acoustic suits the piano better than it does the orchestra which it often drains of colour. Even the very lovely cello melody in the second movement sounds a little uninvolved. Both soloist and orchestra play the right notes, that they wouldn't is unthinkable.

The concerto is not a difficult work technically, though it might well be one of the finest ever written. But the general effect is too often pallid emotionally. And the fact that you are hearing Richter playing it like this makes it all the more disappointing.

Both Richter and the orchestra seem a little more committed in the Intro and Allegro Appasionato though I still wouldn't class it as Richter at his best—or Schumann either for that matter. The orchestra sounds a little more spirited than in the concerto, perhaps because of a change of conductors. But it gets a little shrill in the fortissimo passages of the Allegro.

In the Novelette No. 1 you can hear the Richter-Schumann combination as you'd hoped to. Here Richter's playing is authoritative, gracefully phrased and subtly inflected. This is quite ravishing.

In the Toccata Richter gives an exhibition of terrific technique. He plays it at a blood tingling pace that, however, never causes the listener a moment of anxiety. You know that even at Richter's apparently reckless speed that nothing can possibly go wrong. The performance has almost intolerable brilliance, if I might be permitted to use so well worn a phrase.

* * *

RACHMANINOV—Piano Concerto No. 2 in C Minor. Rhapsody on a Theme by Paganini. Philips Stereo 6500 920.

This disc is most certainly not one of the better examples of modern engineering, an unusual comment to have to make about a Philips product. The orchestra provides a muddy and not always attractive background—that is when it can be heard through the too forward placing of the piano.

Haas plays the concerto well enough but it would be kinder to all concerned to keep this notice brief and simply say that there are many better examples of the work available. One good thing I can state however; it offers generous playing time with the two pieces on the same disc. And I liked Imbal's orchestra better in the Paganini, though the piano was still recorded too far forward. Imbal's orchestra in this work hasn't the same tendency to separate in climatic moments as it does in the concerto.

* * *

BEETHOVEN—Piano Concerto No. 5 in E Flat Major. Wilhelm Backhaus and the Vienna Philharmonic Orchestra conducted by Hans Schmidt-Isserstedt. Decca "World of the Great Classics", Stereo Series SPA 452.

This recording was first issued back in 1960 and is re-issued now with very happy results, especially for those interested in the complex musical personality of the soloist. Classical by temperament, to me Backhaus always seemed to immediately control—and cancel in the following bars—any tendency to self-indulgence that might creep into an interpretation. He constantly reminded me of a very strict master correcting a greatly gifted pupil.

Backhaus had recorded "The Emperor" previously to the performance recorded here. It was, as I recall, a disappointing performance by so fine a pianist. This present re-issue of his 1960 recording is much better, indeed much of it conforms to its imperial title. Thus the first movement is truly masterful, broad in concept and persuasive in its unrelenting forward progress. The slow movement provides a beguilingly poetic contrast yet without a hint of sentimentality.

The Finale is a curious mixture of styles. It often threatens disaster which never happens and includes an occasional rubato that is difficult to explain. The engineering is good even when its early period is remembered. The balance is always perfect, both between soloist and orchestra and in the orchestra itself. That it is slightly reverberant can easily be overlooked. The orchestral playing gives you all you'd expect from Schmidt-Isserstedt if you remember the splendid set of Beethoven symphonies he recorded not long before his death.

Despite many good rival recordings I don't think you'll be disappointed in this one if you acquire it, especially since it is issued at a budget price.

By the way, "The Emperor" was composed after Beethoven's admiration for Napoleon had faded and Beethoven would have disapproved of its nickname with even more than his customary violence. Remember his cancellation of his dedication of the "Eroica Symphony" to the same soldier?

* * *

VAUGHAN WILLIAMS—Fantasia on the Theme by Thomas Tallis. Fantasia on Greensleeves. The Lark Ascending. Five Variants of Dives and Lazarus. ARGO Stereo ZRGA696.

Three of these pieces will be very well-known, perhaps even sound a little hackneyed, to lovers of Vaughan Williams' music. The fourth, Five Variants of Dives and Lazarus, will not be so familiar. In the Tallis Fantasia the sound is so rich that Marriner could quite easily be using a rather larger than usual chamber orchestra, although this is extremely doubtful and is due to the combination of beautiful string tone and splendid engineering. The result is quite overwhelmingly delicious!

Marriner's faultless sense of phrasing and inflection and his sudden use of forte-pianos are all controlled with immaculate unanimity and without the slightest distortion of the composer's pure line. The strings of the St. Martin's Orchestra have never sounded better. The only thing I can say is listen to it and hope you get the same thrill as I did.

In Greensleeves, Marriner—to my mind quite correctly—lets the melody speak for itself without over-elaboration of inflection. It is as if Marriner were

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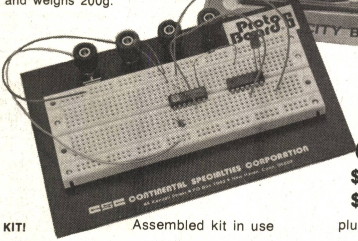

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reminding us that it is, after all, a folk song, nowadays at any rate, though its origin still remains obscure.

In The Lark Ascending the solo violinist, Iona Brown, has the sweetest tone imaginable and a technique that overcomes the piece's many difficulties without the slightest apparent effort. And again, as in the whole disc, the engineering is superb.

In the Dives and Lazarus you will hear the same superlative standard of excellence. In short this is a record that no lover of Vaughan Williams should miss even if the buyer already owns some of the items.

* * *

TORROBA—Sonatina. Nocturne. Suite Castellana.
PONCE—VALSE. Theme Varie et Finale. Twelve Preludes. John Williams (guitar). Westminster Stereo WGS 8109.

As Ecclesiastes 12:12 has it—slightly differently—"Of the making of many guitar records there is no end". So that to all but guitarniks a new disc has to be superlative to be welcomed with any great enthusiasm.

John Williams' name on a record sleeve usually guarantees this very high standard of excellence and he doesn't disappoint here. He plays a recital of necessarily well-worn pieces from the instrument's poverty-stricken literature, with all the expertise one has come to expect from this superb player. But in this recital he gives them all a fresh new complexion.

Technically faultless his playing always has refreshing spontaneity that I personally find delightful. The engineering has excellent presence with a slight tendency to reverberation and the occasional sound of a finger on a fret. Well does he deserve the very high praise that Master Segovia used about his distinguished disciple. A disc to enjoy, not only by guitar buffs but also by everyone with a love of perfectly performed music.

* * *

MOZART—The Two Flute Concertos. Andante for Flute and Orchestra. James Galway (flute) with the Lucerne Festival Strings conducted by Rudolf Baumgartner. RCA Eurodisc Stereo LRL1 S109.

The name of flautist James Galway has recently bounded into prominence. He even made the cover of the January issue of the English magazine "Gramophone". Yet this disc is the first of his that has come my way and if it is a true sample of his usual playing one can find many reasons for his sudden eminence.

The playing of the concertos is utterly delightful and their interpretations fittingly adequate. The balance now and again favours the orchestra in places where it is not altogether welcome. And occasionally Galway's vibrato, may sound a little wide, though this did not bother me.

I don't think it necessary to add that his technique is impeccable. Another point—you don't often hear him taking breath between phrases, a fault that can spoil many a fine recording.

There is some interesting information about him on the record sleeve. Galway is the son of a Belfast working man, who didn't prevent his family from being interested in the arts and, indeed, encouraged James in his study of them.

Now we come to something really unusual. I quote: "Galway had his silver flute custom-made by one of the best manufacturers in the world, A. K. Coopers of London, in accordance with his own mathematical calculations; having been dissatisfied with the intonation of his earlier instruments, he had discovered that traditional models, being made for a lower tuning, were wrongly proportioned. This led to consequent imperfections in intonation, especially in the lower and upper registers".

I might mention that in the photograph of Galway on the cover he appears to be holding a gold flute and not a silver one.

Dvorak: Symphony No. 9—recommended

DVORAK—Symphony No. 9 in E Minor (From the New World). New Philharmonia Orchestra conducted by Riccardo Muti. EMI Stereo OASD3285.

To be confronted at my age with still another recording of this popular symphony is a daunting experience. What is to be said for or against it when many memorable forerunners are recalled? If the notes are correctly played and fractional differences of phrasing and tempo observed, how does one recommend one performance at the expense of another?

From memory my favourite performance was Szell's with the Czech Symphony Orchestra. But that was on pre-war shellacs and at that distance of time my memory might well be betraying me. Muti's reading starts inauspiciously in an orthodox way. But the further one gets into the work the more one realises that here is a performance to listen to with full attention because of its many subtleties.

To dispose of the engineering first, it is absolutely first rate with a very wide but never unwieldy range of dynamics. Add the fact that the New Philharmonia Orchestra has played it even more often than I have heard it and this becomes of extreme importance. The playing is, of course, perfect and the musicians obviously obedient to the conductor's every demand. The balance, too, is always faultless.

Muti's tempos are normal except for some very significant departures, all of them brilliantly effective and none self-indulgent. There is no showing off in the production of violently contrasted dynamics as is the habit of so many of the peacock type of conductors.

The first movement is peerless in its mood and execution. And when one comes to the slow movement the restrained opening bars of the brass are completely captivating with the rest of the movement quite wonderfully unruffled. This is followed by a most beautifully played cor anglais solo.

The market place bustle of the first theme of the Scherzo is lovingly contrasted with the more rustic second subject. But this is never overdone by the slightest trifle and the third theme is enchanting in its dance-like rhythm. The whole movement is a delight for jaded palates. The Finale too is first rate, solidly boned with intervals of superlative daintiness. Playing of such quality demands the utmost concentration on the part of players and conductor alike and this is never once allowed to wander. Very strongly recommended.

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Reviews of other recordings

Devotional Records

PRAISE II. Stereo, Maranatha Music, HS 777-26. (From S. John Bacon Publishing Co, 12-13 Windsor Ave, Mount Waverley, Vic 3149.)

According to the jacket credits, there was quite a team behind the production of this album—thirty-four vocalists and musicians plus another sixteen or so arrangers, technicians, photographers, and so on.

Appropriately, the result of their efforts should find a very wide appeal. The Gospel songs are new but the themes are as familiar as the scripture themes on which they are based. Both lyrics and references are given in full in the double fold album: Sing To The Father —Praise You Father — Light Our Way — Christ In Me — Unto Thee, O Lord — Servant Of All — Sing Hallelujah — O Come Let Us Adore Him, Thou Art Worthy — Open Our Eyes — My Peace.

Like the words, the musical arrangements belong to the present but the orchestral voices are traditional and my tip is that it will be enjoyed as much by the older generations as by the younger.

And, quality wise, the sound is very round, very smooth, and very easy to listen to. This is a good one to add to your family collection. (W.N.W.)

★ ★ ★

JUST GOOD LISTENING. Various Artists. Stereo, Singcord ZLP-947S. (From S. John Bacon Publishing Company, 12-13 Windsor Ave, Mount Waverley, Vic 3149.)

"Just Good Listening" has two connotations here: firstly, the selections are all in the melodic "middle of the road" style made popular by some broadcast stations; secondly, they are sample tracks from a dozen albums which, by inference, also provide Gospel "good listening". The tracks and artists: He's The One (Dick Bolks Singers) — Love Was When (Jim Bell) — The Miracle Theme (Paul Mickelson Singers) — Showers Of Blessing (Lang Sisters) — Walk With Me (Billy Speer) — In Pleasant Places (Ellen Roweton) — God Loves You (Steve Boalt) — Has Anyone Told You (Sixteen Singing Men) — He Leadeth Me, Medley (Johnny Hall) — Gentle Shepherd (Rick Powell Singers) — Happy Am I (The Renaissance) — Jesus Is Coming (Sixteen Singing Men).

As one might expect of a sampler record, quality is well up to standard and, all told, it adds up to a pleasantly varied Gospel program for relaxed family listening. (W.N.W.)

★ ★ ★

PRAISE THE LORD. Wanda Jackson. Stereo, Capitol (EMI) ST-11023.

As the jacket notes point out, Wanda Jackson has been a concert and recording artist since the age of fourteen. But more recently, she and her husband/manager have become practicing Christians, with their membership at the South Lindsay Baptist Church in Oklahoma City, USA.

Now a regular soloist and speaker at Gospel rallies, the songs on this album are her personal testimony: The King Is Coming — My Testimony — Didn't He Shine — He Gives Us All His Love — People Gotta Be Loving — How Great Thou Art — Am I Not My Brother's Keeper — Oh Happy Day — He's The Man — Battle Hymn Of The Republic.

With orchestral and vocal backing, including "The Oak Ridge Boys" in some tracks, the numbers vary in theme and style from the quietly personal to exhuberant driving rhythm—but devotional all the way.

The whole performance stamps Wanda Jackson as the accomplished popular vocalist that she is but somehow the conviction comes through very strongly — what she's singing here is for real. And maybe that's reason enough for many to be interested in her new album. (W.N.W.)

★ ★ ★

GLOW IN THE DARK. Chuck Girard. Stereo, Good News Records GNR-8103. (From Sacred Productions Aust, 181 Clarence St, Sydney and other capitals).

Chuck Girard composed all the songs on this album and, to make sure that you get the message contained in them, the lyrics are printed in full on the inner sleeve. And they say what youth is saying—and asking—today. Questioning insincerity, expressing old convictions in new ways, and then sometimes taking up the traditional again with new understanding. The titles:

Calling You — I Remember — Return — I Know A Lady — No, No, You're Not Afraid — Somethin' Supernatural — When I Was Ready To Listen — So Thankful — Old Dan Cotton.

As you might guess, the music for the lyrics is essentially music for the now generation, modern in style and most of it rock ranging from gentle to hard. Yet weaving through it there are string and other traditional orchestral sounds which evoke an admiration for the arrangers.

An imported album, the record is well presented and well up to standard in the technical sense. As I said, Gospel which will commend itself to the now generation. (W.N.W.)

Instrumental, Vocal and Humour

HEADING IN THE RIGHT DIRECTION. Festival Studio 24 Orchestra. Festival stereo L 25270.

Frankly I had expected this album to be the usual "musical wallpaper" broadcast by a few radio stations under the label "easy listening". But as the sleeve notes describe it, the album "is probably the first attempt in Australia to marry the lush string sound to a driving but subtle disco beat". As it happens, the rhythm is anything but subtle but is likely to be all the more popular because of it. If you like the style of Paul Mauriat and his orchestra, then this album is for you. Recording quality is good.

Track titles are as follows: Love Will Keep Us Together — Love To Love You Baby — Heading In The Right Direction — Mama Mia — Right Back Where We

Reviews in this section are by Neville Williams (W.N.W.), Jamieson Rowe (J.R.), Leo Simpson (L.D.S.), Norman Marks (N.J.M.), David Edwards (D.W.E.) and Greg Swain (G.S.).

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Started from — Long Tall Glasses — Africa (L'ete Indien) Breakfast For Two — Can't Give You Anything (But My Love) Poloma Blanca — Rock Me — Sailing. (L.D.S.)

★ ★ ★

PROSIT, 150 YEARS OF JOSEPH STRAUSS. Vienna Philharmonic, Willi Boskovsky. Decca SXLA 6817.

Probably nobody epitomises Viennese musical traditions and Strauss music in particular more than Willi Boskovsky, and Decca are to be thanked for making such a combination available on this enjoyable record.

The sleeve notes in English, French and German, give notes on each of the ten tracks, about the reasons for writing them, and the time and place of their first public performance.

The titles are: Delerium Waltz — Jockey Polka — Gay Spirit — Transaction Waltz — Fireproof Polka — Village Swallows From Austria Waltz — Carefree Polka In Flight, Fast Polka — The Course Of My Life Is Love And Joy, Waltz — Little Chatterbox, Fast Polka. The quality is good although the recording level is a little on the low side. (N.J.M.)

★ ★ ★

LEROY ANDERSON FAVOURITES. Utah Symphony Orchestra, Maurice Abravanel. Astor Masterworks Collection MWC 1009.

Fifteen of the best known musical bon bons are offered on this delightful disc from Astor's Masterwork series. Most of the tracks are best described as descriptive pieces, with such titles as — Sleigh Ride — Syncopated Clock — The Sandpaper Ballet — The Typewriter (being the best known) with others like — Blue Tango — Trumpeter's Lullaby — The Belle Of The Ball — The Bugler's Holiday — Plink, Plank, Plunk — Fiddle Faddle — Sarabande — Song Of The Bells — Jazz Pizzicato and Serenata making up the list.

The Musicianship of the Utah Symphony conducted by Maurice Abravenel is never in doubt and the recording quality is good, although you won't need much bass boost. In short, a record to enjoy often. (N.J.M.)

★ ★ ★

CARNIVAL IN RIO. Carioca Carnival Orchestra. Hispavox stereo L35751. Manufactured and distributed by Festival Records Pty Ltd.

Latin-American music in a raunchy style could best describe this album. A big bold and brassy orchestra with a heavy rhythm section pounds out the bright and bouncy arrangements. There is an occasional backing with a chorus. Recording quality is only run-of-the-mill but the nature of the music makes this relatively unimportant.

Thirteen songs are presented in all, some in medley form: Mama Eu Quero — Cae Cae — Ay, Cosita Linda — Vendo El Rico Pastel — Para Vigo Me Voy — Camino De Lunas — Capullito De Aleli — Mama Inez — Natzu Batzuba — Carioca R — Rumbeos — Bim Bam Boom — Fantasia Para Dos Gaviotas Enamorados. (L.D.S.)

★ ★ ★

SECRET LOVE — ALL-TIME FILM FAVOURITES. Los Indios Tabajaros. RCA Victor stereo. APL1-1033.

Those not keen on orchestral film music may well be attracted by this album. Los Indios Tabajaros put out some very relaxing renditions of film tunes which have been standards for a long time. Recording quality is good.

The twelve tracks are as follows: Secret

Malcolm Muggeridge speaks out

Malcolm Muggeridge
The Sixth Sir Robert Gordon Menzies Lecture Perth 1976

MALCOLM MUGGERIDGE. The Sixth Sir Robert Gordon Menzies Lecture, Perth, 1976. Stereo, M7, MLF-165.

As the jacket notes point out, Malcolm Muggeridge caused quite a stir when he, as a socialist, materialist and agnostic embraced the Christian faith, and began to lecture from that standpoint.

In this lecture, delivered in Perth, Australia, Malcolm Muggeridge thinks back over his many journalistic roles and tends to dismiss them as an exercise in producing what people want to read. He deplores the way western civilization has so elevated fantasy, especially per medium of television, that we have tended to dress up wrong so that it becomes right, and to denigrate traditional moral values so that they have become suspect, even "wrong". And, while we agonise about political crises, economic crises, oil crises, and so on—behind them all is the fundamental crisis: confusion between right and wrong.

The theme is familiar, the voice is familiar and the presentation is familiar and it is not for me to decide whether you have a place for this album in your collection. But, if you want a sample of an address by the man who is known affectionately—and derisively—as "saint Mugge" this would be a good one to get. (W.N.W.)

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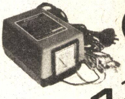

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* * *

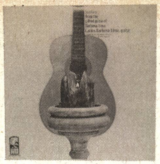
SCARLATTI from the gifted guitar of Barbosa-Lima. Westminster Gold stereo WGS-8209. ABC Records Inc. Distributed by RCA Records Pty Ltd.

"How silver-sweet sound lovers' tongues by night, Like softest music to attending ears!" This quote from 'Romeo and Juliet' seems to refer to the music on this album although the bard lived hundreds of years before composer Domenico Scarlatti.

Interestingly, these works originally composed for the harpsichord just fit the guitar, which was first demonstrated by none other than Andres Segovia. And it is no accident that Carlos Barbosa-Lima performs these transcriptions. He is a rare protege of the ageing Segovia. At the age of 28 Barbosa-Lima is an acclaimed guitarist world wide and his reputation is sure to grow, if this recital or Scarlatti sonatas is any indication.

To match the flawless performance is a very high recording standard and negligible surface noise.

Nine sonatas are presented in the recital. Kershel and Longo numbers are quoted. Recommended. (L.D.S.)



* * *

THE MAGIC FLUTE OF JAMES GALWAY. With the National Philharmonic Orchestra conducted by Charles Gerhardt. Stereo, RCA LRL1-5131.

"Magic" flute or "virtuoso" flute? Either term would be appropriate for this diverting performance by James Galway. For his recital he has chosen transcriptions of familiar excerpts which epitomise a range of moods and skills for a flautist who seems not to be troubled in the slightest by what the jacket notes refer to as "pulmonary limitations".

The Arrival Of The Queen Of Sheba (Handel) – Vocalis (Rachmaninoff) – Allegro From Sonata No 4 (J. S. Bach) – Scherzo From A Midsummer Night's Dream (Mendelssohn) – Traumerei (Schumann) – Tambourin (Gossec) – Variations On A Theme By Rossini (Chopin) – Schon Rosmarin (Kriesler) – Humoresque (Dvorak) – Carnival Of Venice (Briccialdi).

You may think that ten tracks of lead flute might be a bit much for a sitting but I can assure you otherwise. With full orchestral backing, varied themes and the ever-changing facets of a dazzling virtuosity, it is at the one time musically entertaining, and fun!

Technically, the orchestral sound is a trifle "stringy" although the flute itself is good; but I think you'll enjoy it just the same. (W.N.W.)

* * *

POP GOES THE MOOG. The T Tone Synthesizer. Interfusion L 35914. Festival release.

This record was produced by a MOOG III synthesizer, programmed by H. Matsutake. The cover notes give me the impression that it is intended to be disco music, but to my ears it seems more like background music. As one has come to expect from synthesizers, there is a wide variety of sounds, all of which seem to be very clean, even antiseptic.

The songs selected are all from the "American Graffiti" era, and while they are given a pleasant treatment, I personally would still prefer the originals, both as disco or background music. Technically, the record is good, with a good stereo spread. (D.W.E.)

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20-20 VISION. Ronnie Milsap. RCA Victor APL1-166.

Ronnie Milsap has turned out another very professional album. His forte is the slow love ballad, and he manages to convey more sincere feeling than most country and western crooners. None of the tracks will be generally well known, with the exception of "Lovesick Blues" which I particularly enjoyed.

Other tracks that you might like to listen to, just to get the atmosphere, are "Lovers, Friends and Strangers" and "Not that I Care". His very feeling rendition of "20-20 Vision" seemed to be rather ironic, considering that Ronnie Milsap is blind. As well as handling the singing, Ronnie accompanies himself on piano.

The recording quality matched up to the very fine performance, making this album a worthwhile addition to any C & W collection. (D.W.E.)

★ ★ ★

JESSIE COLTER. Jessie Colter. RCA Victor LSP-4333.

On the cover of this record there is a large amount of information about how good Jessie is, volunteered by one Waylon Jennings, one of the co-producers (another one is Chet Atkins). What he doesn't tell you, however, is that Jessie Colter is his wife. Knowing that last little piece of info, I approached this album with some degree of caution

But I must admit that the album is indeed very pleasant to listen to (I always tell everyone how good a cook my wife is, but then I'm only preserving the peace!). Jessie has a very pleasant voice, and she wends her way through a quite varied selection of songs. By the way, according to Waylon, a fair number of the tracks were written by Jessie (under a nom de plume), so what he has to say must be right!

So, if you want to sample a new talent in country and western music, give this album a try. As is usual with RCA Victor releases, the recording quality is excellent. (D.W.E.)

★ ★ ★

THE BEST OF CHARLEY PRIDE VOLUME III. Charley Pride. Stereo. RCA Victor APL1-2023.

Charley Pride is perhaps the best country and western singer at present recording, and he is certainly one of my favourites. So I won't bore you by telling you how great he is, but will just list all the tracks so that confirmed fans will know what they are getting.

In order, the tracks are as follows: I Don't Deserve a Mansion — My Eyes Can Only See As Far As You — The Happiness Of Having You — Hope You're Feelin' Me (Like I'm Feelin' You) — I Ain't All Bad — Then Who Am I — Mississippi Cotton Picking Delta Town — Searching For The Morning Sun — Amazing Love — Don't Fight The Feelings Of Love — Oklahoma Morning.

Recording quality is above average, with negligible surface noise. (D.W.E.)

RECOMMENDED

MARGRET ROADKNIGHT. Margret Roadknight. Infinity L 36045 Festival release.

This album is a mixture of blues, ballads and jazz. Combined with Margret's throaty, mature voice, the sound is quite unusual. There is a definite quality here that I recognize—my appreciation of this record will improve with playing.

Her version of "Girls In Our Town" manages to be soulful and sad, overcoming its former association with Bob Hudson. Other selections are original and unusual: Try "Love Tastes Like Strawberries" and "Minuit II" for an indication.

The quality of this recording is excellent. I was listening very carefully to the effects of the different instruments used, and was pleased not to have it spoiled by background noise. Recommended for something a little bit different. (D.W.E.)

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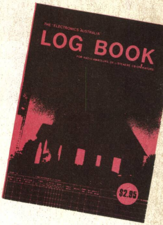

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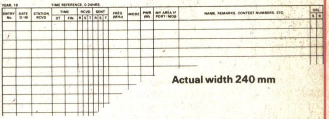

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New Products

100MHz & 600MHz frequency counters from Scientific Electronics

Two new frequency counters have been added to the range of locally designed and manufactured instruments produced by a Victorian firm, Scientific Electronics. Offering guaranteed frequency ranges of 100MHz and 600MHz respectively, the new counters offer high performance and reliability at attractive prices.

Designated the DFM100 and the DFM600, the two new Scientific Electronics counters both come in compact cases measuring 220 x 85 x 250mm (W x H x D), and weigh only 3kg. Both also feature 7-digit LED displays with 12.5mm-high digits, pushbutton range and function switching, and a number of other features.

The circuitry of the counters employs current TTL/ECL technology. The input amplifier of the DFM100 is capable of operating above 150MHz, while the prescaler of the DFM600 uses the Fairchild 11C90 ECL device with its performance extending well beyond 600MHz.

Input impedance of the DFM100 is 1M shunted by less than 20pF, and the DFM600 provides a similar input for signals below 100MHz. For signals above 100MHz the DFM600 provides a separate input for the prescaler, with an input impedance of 50 ohms.

Input sensitivity for the high impedance input of both instruments is better than 25mV RMS up to 80MHz, and better than 35mV RMS from 80 to 100MHz. Sensitivity of the DFM600's prescaler is better than 350mV P-P up to 600MHz, and better than 400mV P-P up to 750MHz. Both instruments will accept up to 200V RMS up to 10MHz and up to 5V from 5MHz to 100MHz. The prescaler of the DFM600 will accept up to 1.2V P-P.

A feature of both counters is a switchable 1MHz low pass filter on the direct input, to permit accurate measurement of lower frequency signals in the presence of noise. Both counters also provide a self-checking function, 10MHz oscillator reference output, provision for external timebase and ratio measurement capability. They also feature a 3-step input attenuator, over-range and display update indicators, and Hz-kHz-MHz range switching.

The internal 10MHz crystal oscillator used for generating the timebase signals has high stability. Crystal ageing rate is quoted as 0.3ppm per month, while temperature coefficient is 5ppm from 0 to 50°C, and dependence on line voltage 1ppm for 10% variation. The MHz signal available for external use is typically 50mV RMS, with an output impedance of 50 ohms.

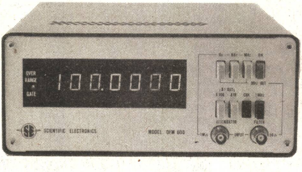
Both counters have a rated operating temperature range of 0-45°C. They can be operated from either 117V or 234V AC, ±10%, with a frequency between 47 and 64Hz. Loading is a nominal 40VA.

Both instruments are sold with a full guarantee for 12 months.

In their literature Scientific Electronics describe the new counters as high performance, reliable low cost instruments which have been designed especially for use in production line testing, servicing, education and training, calibration, frequency monitoring and telecommunications. Leading zero blanking and automatic decimal point positioning make them particularly easy to read, even by unskilled personnel.

Scientific Electronics believe that both the DFM100 and DFM600 counters compare very well with imported competitive instruments, and demonstrate that local design and manufacture is more than viable in this product area. In particular the DFM600 is very competitive at its quoted price of $398 plus tax.

Apart from frequency counters, the firm also makes a wide range of power supplies, including both modular and bench type units.



This is the DFM600 counter, which measures to beyond 600MHz. The 100MHz model is almost identical, and offers the same high performance.

For further information on either the counters or supplies, contact Scientific Electronics at 42 Barry Street, Bayswater, Victoria 3153. Telephone 03 729 3170.

Video game from Hanimex

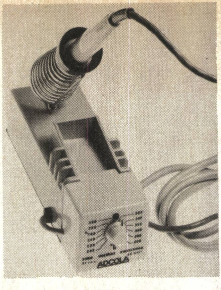
Hanimex Corporation has released a new video games unit which provides a choice of four games, and a variety of other options.

The games provided are tennis, squash, hockey/soccer, or practice. Sound effects and on-screen scoring are provided, with game scoring facilities on the console. Options include two ball speeds and two serve angles, two bat sizes (normal and tournament) and manual or automatic serve.

The game control handsets lift away from the console for remote use. The game normally operates from 6 internal "C" type dry cells, but may be connected to an AC adapter. It has facilities to connect to any normal TV receiver via either 75-ohm unbalanced or 300-ohm balanced aerial inputs.

Inquiries regarding the game may be directed to Hanimex Corporation, Old Pittwater Rd, Brookvale, NSW.

Soldering tool conversion kit



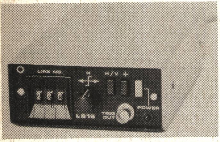
Adcola Products has now developed a 'clip-on' unit which converts older temperature-limiting soldering pencils from mechanical to electronic temperature control.

The clip-on unit provides infinitely variable temperature control from 200°C to 400°C, the desired temperature being simply selected on the direct reading scale by means of a pointer knob. The 24V Adcola soldering tool provided with the unit incorporates electronic feedback temperature sensing, and can be supplied with either a 3mm or a 5mm diameter tip.

Once the tip profile has been decided on, the full temperature range is available without having to change the tip. Further, it is not necessary for a replacement tip to heat up from cold when a temperature variation is required. Tip inventories are reduced to profile variation only, and tip temperature identification requirements are eliminated.

Further information is available from Adcola Products, 22 Firth St, Doncaster, Vic, 3073.

TV line selector



The LS16 is a compact instrument designed primarily to extend the operational range of conventional and low cost oscilloscopes by providing comprehensive triggering facilities on composite video waveforms. Its main function is to accept a 625 line/50Hz field composite video signal, and extract the line, frame and half frame synchronising components of this signal and output one of these in the form of a trigger pulse.

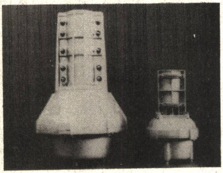
Phasing of the frame and half frame trigger pulse is achieved by means of a 3-digit thumbwheel selector switch and a line vernier potentiometer on the front panel of the instrument. Thus the frame and half frame trigger pulse (which is of one TV line duration variable by the line vernier potentiometer) may be selected to coincide with any line between 1 and 625. In this context one immediately evident application of the LS16 is in monitoring and evaluating vertical interval test signals and the four field sequence of burst blanking.

Phasing of the horizontal trigger pulse is continuous and achieved by means of the line vernier potentiometer on the front panel. Thus one edge of the trigger pulse (which occurs at line frequency) may be positioned anywhere within the active line.

In addition to the trigger output the instrument provides a composite sync (as separated from the incoming signal) output and a composite video output. The latter supplies a clamped video signal which may be mixed with an internally generated signal to give a white cross-hair display on a monitor indicating the position of both the horizontal and vertical trigger pulses.

For further details contact Arlunya Pty Ltd, PO Box 113, Balwyn, Vic. 3130.

Antenna rotators



A new range of Japanese made heavy duty antenna rotators is now available for amateur radio and commercial use. The largest model handles a rotating torque of approx. 250Nm^2 for a maximum load of 2,500kg. The smallest in the range has almost identical specifications to the popular American made CDE Ham 11 series, with a rotating torque of approx. 85Nm^2 for a maximum vertical load of 250kg.

All rotators come complete with a 240V AC operated control box with a direction indicator and facilities for electrically braking the rotator.

Enquiries to Vicom International Pty Ltd, 139 Auburn Rd, Auburn, Victoria.

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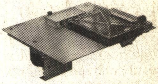
A wide variety of head and channel configurations with optional electronics to suit custom designers of broadcast, educational and entertainment systems.



MODEL 36 ENDLESS LOOP CARTRIDGE TRANSPORT
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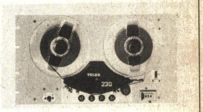

MODEL 230 OPEN REEL TRANSPORT
- Three motors, two speed, solenoid controls, high efficiency braking, four head facility, tape lifters, photo cell tape stop.

MODEL RP85 RECORD/PLAY PREAMPLIFIER
- Use with model 36 or 230 or most other transport systems. Direct head connections N.A.B. equalization for 3 speeds, -60DB bias rejection, optional rack mounting panel.

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28 Gray Street,
Kilkenny 5009
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10 Buchanan Street,
West End 4101
Telephone: 44-6844

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Hawthorne 3122
Telephone: 819-2363

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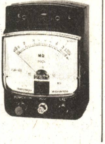

7

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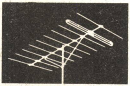

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The CSC "Proto Board 6" breadboarding aid is ideal for use with both digital and analog circuits, especially those involving integrated circuits. It is supplied as a kit, and is assembled by the user.

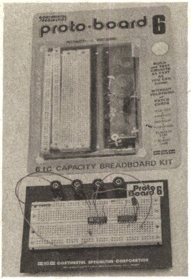
The heart of the unit is a special socket array, consisting of ninety four rows of contacts, with each row having five contacts. Dual-in-line integrated circuits can be plugged into these sockets, allowing four additional contacts per IC pin. Four additional contact rows are supplied, each with forty sockets, for use as power supply bus lines.

The socket is mounted on a metal baseplate, measuring 152 x 101mm. This is fitted with four terminals, three red and one black. Each terminal can be used with either stripped wires or banana plugs.

Connections from the terminals to the socket, and from point to point on the socket are made with tinned copper wire. This must be single stranded, and preferably insulated. Wire is not supplied with the kit, but should be readily available at most electronic supply centres.

While the unit is intended mainly for use with integrated circuits, discrete components can be accommodated, since their lead sizes are in most cases suitable for insertion into the sockets.

The black terminal is connected electrically to the base plate. It is intended to be used as the negative or ground power supply connection point, thus utilising the base plate as a shield. The bottom of the base plate is fitted with four rubber feet, to allow clearance for the terminal posts.


proto-board 6
6 IC CAPACITY BREADBOARD KIT
Proto Board 6
CONTINENTAL SPECIALTIES CORPORATION

The Proto Board 6 is distributed in Australia by General Electronic Services, of 99 Alexander Street, Crows Nest, NSW. It normally retails for about $22.00 but, as a special offer to readers, our Reader Service Dept., in conjunction with General Electronic Services, is making the unit available at a significantly reduced price.

Students who can claim tax exemption may purchase the unit for $16.95, plus $1.00 postage, while the price including tax is $18.95 plus $1.00 postage. For further details, refer to the advertisement elsewhere in this issue. (D.W.E.)

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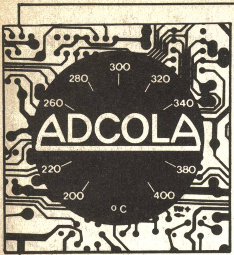

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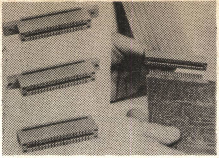
Card edge connectors



Ansley Electronics has introduced a new series of BLUE MACS card edge connectors that can be mass terminated to round or flat conductor cables in seconds, without wire stripping. Designed for double sided PC boards with pads on .100" (2.54mm) centers, these one-piece connectors feature self-aligning cable grooves which automatically position the cable conductors over the exclusive Ansley TULIP contacts.

The PCB pad mating portion features reliable bifurcated cantilever contacts that tolerate irregular PCB pad surface variations. These heat treated beryllium copper contacts also assure a maximum number of failure-free connect and disconnect cycles.

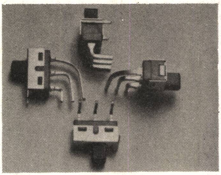
The 609 connector series include three mounting ear options, in eight contact position versions from 10 to 60, with a 94 VEO flammability rating, −55°C to +105°C temperature rating, 1A current rating, and 500 VDC dielectric strength at sea level.

For more data, contact Ansley Electronics, PO Box 91, Brookvale, NSW 2100.

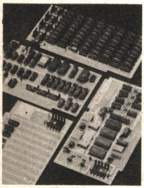
PC mounting slide switch

New from C & K are these 6A subminiature slide switches with either right angle (Models 1101-AQ and 1101-AVQ) or vertical mounting terminals for PC board mounting. The 1101-AQ offers a left to right actuator action, while the 1101-AVQ right angle switch offers an up and down actuator action.

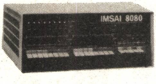
Further information from C & K Electronics (Aust) Pty Ltd, Office 2, 6 McFarlane St, Merrylands, NSW 2160. Tel 682 3144.



THE IMSAI AND POLYMORPHIC



The IMSAI and Polymorphic systems micro computers are 8080 based units accommodating up to 64k bytes of MOS write protect memory. They have a 500 nSec total memory access time and 2 Sec minimum instruction time. Complete systems including programming available for small business at low cost—suitable for: stock control, invoicing, quotations, patient records, typesetting.



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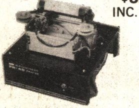

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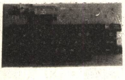

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Telex: Melbourne, 31447 Sydney, 21707. Brisbane, 41500. Perth, 93244.

RHC 6566

Letters to the editor

Overwhelming response

We would like to thank you for the review of our Heathkit ICL-2009 Calculator Kit in the March issue, although the response from your readers was far greater than we all anticipated.

When we were advised that the review was going to be printed, our stocks were in excess of six hundred units, but within a few days of the release of your March edition, we were completely out of stock.

So far, we have received requests from readers for over three thousand kits, as well as a large number of telephone calls and letters asking if we have any kits left.

Unfortunately all of our branches are now out of stock and so is the factory in the USA. We therefore are unable to supply all orders.

We are writing to everyone that has sent an order that we could not supply. Also we would like to offer our apologies to everyone who has missed our offer on the Calculator Kit.

To all of your readers who did get a Calculator Kit, or for that matter any other Heathkit, we would like to remind them that we are always available for advice, and assistance until the kit is assembled and operating up to the specifications.

N. Skeen
Supervisor, Heathkit Centre
Warburton Franki Industries
South Melbourne, Victoria

Nuclear energy

The argument for nuclear energy put forward by Sir John Hill in the March issue is typical of the nuclear industry's attempts to gloss over the arguments put forward by these opposed to it. His article does not even detail the major problems associated with the industry, let alone the failure of the industry to deal adequately with them.

His claims on the employee safety of the industry have a hollow ring when we consider that the U.S. Public Health Service has estimated that 10-20% of miners who worked underground mines will die of lung cancer due to radon gas exposure on the job. Consider further the fact that continuing medical histories of employees associated with plutonium have only been kept in the U.S. since 1968, and in Britain since 1975. This is particularly significant in light of the fact that less than one microgram of plutonium, lodged in the lung, causes cancer which may not manifest itself for fifteen years. Plutonium, a necessary by-product of nuclear reactors is now produced by the tonne.

Sir John's faith in the ability of agreements and treaties to control nuclear weapons, is not well founded. India developed and exploded a nuclear device made from materials manufactured in a "peaceful" reactor supplied by Canada much to the embarrassment of the Canadian government. The Nuclear Non-proliferation Treaty is a weak document, giving signatories the right to opt out with three months' notice. The inspection rights of the International Atomic Energy Agency are almost laughable, with prior notice being given before inspections take place. It has a staff of about 70 technicians, and an annual budget of around five million dollars. Most of its work is inspection of records, and it has no power to take action if infringements are found. We should note that the Fox Report says

REPUTATION

Reputation cannot be bought! A good reputation is earned with consistent quality and service
C & K OF AMERICA, has a sound International reputation for quality products – Switches perfected and produced almost entirely by automation.
C & K OF AUSTRALIA upholds this fine reputation as a Specialist Switch Marketing Company offering U.S.A. factory fresh products and service.
The extensive range offers a choice of more than ONE MILLION different switch styles and configurations. Toggle, Pushbutton, Slider, Rocker and Lever Handle actions, a variety of actuators and terminal styles to suit any application ..... Snap-in bezels, LED adaptable types, dressy hardware ..... All these and the recently introduced C & K Thumbwheel Switches.
C & K really care, there's even a special spanner available to facilitate switch mounting.
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(p.185), "The nuclear power industry is unintentionally contributing to an increased risk of nuclear war."

His contention that solutions to the problems of waste disposal will be found in the future, is not reassuring. Radioactive wastes, which future generations will have to guard for thousands of years, is a deadly cart to put before the horse. The record of the industry is already bad on this issue. The worst case is probably the leaks from the Hanford Reservation in Washington state. This facility has had more than a dozen leaks, the largest being approximately 435,000 litres of high-level liquid, including caesium I35 (half-life 28 years), strontium 90 (half-life 30 years), and plutonium (half-life 24,000 years). There were leaks from the Windscale plant in the U.K. last October, which were hushed up for two months until revealed by Energy Secretary Tony Benn in the British parliament. The Rocky Flats plant in Colorado has leaked plutonium into the water supply of nearby Broomfield, creating the demand for a new reservoir. In 1969, this plant had a fire which consumed an estimated two tonnes of plutonium.

The record for accidents and close-calls is also appalling. Here is just a sample:

1952—Chalk River NRX reactor in Canada. Reactor core destroyed after the scram equipment failed to operate correctly.

1955—Idahoe Falls EBR-I reactor in the U.S. Partial core meltdown—reactor destroyed.

1957—Uranium fire (involving eleven tons of uranium) at the Windscale No. 1 reactor in England, resulting in the release of huge amounts of radioactive iodine into the surrounding countryside.

1961—Idaho Falls SL-I reactor. A split-second power excursion killed three men. Their bodies had to be buried in lead-lined casks in lead-lined vaults.

1966—Enrico Fermi Reactor, Michigan—melt-down of four fuel sub-assemblies.

1969—Lucens Reactor, Switzerland—destroyed by loss of coolant accident.

1973—The big Hanford leak (see above).

1975—Browns Ferry, Alabama—a fire, leading to scram on two units (which were supplying 15% of total demand on the Tennessee Valley Authority grid), and resulting in the destruction of all five emergency cooling systems on one of the units.

Sir John's opinion on the difficulty of achieving terrorist objectives also does not stand up against past evidence. In 1972 terrorists hijacked a plane and threatened to crash it into the reactor at Oak Ridge National Lab. In 1973 a group of Argentinians seized control of a partially built reactor and covered it with slogans—they could have bombed it. In 1974, in the United States, sixty-four bombing incidents involved nuclear utilities. In 1975, two French reactors were bombed.

Let's not kid ourselves that nuclear power is a cheap, clean, source of energy. In the U.S., Gulf General Atomic pulled out after losing $600 million, and one of their top executives claimed that none of the four US reactor manufacturers had made a cent out of it. This is despite the fact that the public had borne much of their costs of processing, research, construction, disposal and safeguard of wastes, and of cleaning up after mistakes.

Your reader's should be aware of recent advances being made in photovoltaic cells and other forms of solar energy. Australia is in the forefront of research in these areas due to some dedicated scientists, and in spite of miserable allocations of funds from government. This is the technology we should be pushing—not nuclear power.

Now that I've drawn attention to the other side of the coin, how about exercising a bit of social responsibility to your readers E.A.? I suggest you invite Dr Camilleri from the Australian Conservation Foundation to write an article of equal length, in reply to Sir John Hill.

A.R. Dowsett
Hawthorn, Victoria

COMMENT: You seem to have done quite well already! It is not our policy to give any person or group a "carte blanche" invitation to fill pages in the magazine. However, should Dr Camilleri or anyone else care to submit an article dealing with the negative aspects of nuclear energy, we would be happy to consider it for publication using the same criteria we apply to all other material published—including the article by Sir John Hill.

Operation Electronics

It has been discovered that a number of the mains-operated projects in the Ideas Box of our school electronics kit, Operation Electronics, can become potentially lethal under certain fault conditions.

In the interests of safety we are recalling all Ideas Boxes so that the mains-powered projects can be removed and the kits returned to purchasers. Teachers should note that neither the Manual nor the battery-powered projects are affected.

Those schools in possession of an Operation Electronics Ideas Box should return the cards only (not the Manual) to their original supplier with the invoice. They will be suitably credited.

If purchasers are unsure as to what to do, they should contact Ken Lough in Sydney on 929 4273; Hedley Finger in Melbourne on 699 8922; Shirley Eiby in Brisbane on 398 6543; or Bob Brady in Adelaide on 42 2640. Alternatively they should write to myself at the address given below.

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Books & Literature

Novice primer

MANUAL OF QUESTIONS AND ANSWERS FOR THE NOVICE LICENCE, third edition, by Keith Howard VK2AKX, Published by Westlakes Radio Club, 1977. Soft covers, 208 x 260mm, 122pp, some diagrams.

This is a practical, down-to-earth little book designed to help those with virtually no background to prepare for the PTT Department's Novice Amateur Radio Licence examination. It has been written by Keith Howard, a man well known for his teaching work over many years in the Westlakes Radio Club and in the Youth Radio Club Scheme.

As the title suggests, the book largely follows a question-and-answer format, in line with the examination papers used for the Novice licence itself. It is divided into 10 chapters, and each has a brief discussion of the topic concerned followed by a series of typical questions and expanded answers to guide the reader. The chapter headings are: 1 – Units; 2 – Electrons at work; 3 – Circuits; 4 – Components; 5 – Power Supplies; 6 – Propagation; 7 – Modulation; 8 – Operating; 9 – Transmitters; 10 – Services. The last of these deals with learning Morse code, applying to sit for the Novice examination, and other practical details. The book ends with a helpful data supplement, and a copy of the most recent Novice examination theory and regulations papers.

The approach evident throughout the book is the very pragmatic one of getting the reader successfully through the Novice licence examination. And it should achieve this quite effectively, although some of the theory has been so simplified that it borders on the inaccurate and misleading.

For example the explanation of semiconductor doping on pages 4-15 and 16 suggests wrongly that a crystal doped with a donor impurity conducts in one direction, while another doped with acceptor impurity conducts in the opposite direction. Junction behaviour is not mentioned, nor does it feature in the explanation of diode operation which follows. I believe concepts should never be simplified to the point where a student will have to un-learn them later on.

Similarly the discussion of impedance matching on page 4-15 suggests that crystal microphones were used with valve amplifiers because they were a better match for the high grid impedance. In fact they were used because they had a high output voltage without a step-up transformer—impedance matching as such was an incidental consideration.

There are also a few minor points, like the explanation on page 1-2 of resistance which first describes a conductor as "good" if electrons can flow through it easily, and "bad" if they cannot flow easily—and then describes resistance as the "goodness" or otherwise of a conductor. Wouldn't it have been more logical to describe it as the "badness"?

I don't want to give the impression from these criticisms that the book is not going to help the would-be novice. On the contrary, I think it will be of considerable help. But I believe it would be of even greater value if these points were attended to.

The book is available from Westlakes Radio Club, Box 1, P.O. Teralba, NSW 2284. (J.R.)

Security systems

VIDEO SECURITY SYSTEMS by Keith W. Bose. Published 1976 by Howard W. Sams & Co. Indianapolis. Stiff paper covers, 160pp 137mm x 215mm, illustrated by pictures and diagrams. Price in Australia $7.15.

Lamentable though it may be, there is an increasing need for electronic surveillance in banks, shops and elsewhere. This must be reflected in the number of people involved in planning, installing and maintaining surveillance systems. This book is expressly intended to assist those who may have aspirations in this direction.

Chapters 1, 2 and 3 are largely introductory, dealing in general with closed circuit TV and more particularly with the physical aspects of CCTV cameras, and how they are protected, mounted and remotely driven.

Chapter 4 turns its attention to the TV signal itself, either standard American 525 line 60-frame, or narrow band. Chapter 5 discusses the "transport" of the video signal via coaxial cables, etc.

The remainder of the book is effectively summarised by the chapter headings: Cameras, monitor and video recording; Lenses; Video switching; Accessory equipment; Signal processing, special effects & colour; Alarm systems; Installations; Glossary.

Keith Bose, a lecturer and writer and

a man with a considerable background of technical experience, writes concisely and deliberately and his new text could be an excellent starting point from anyone planning to branch out into the video security area.

Our copy came from Prentice/Hall of Australia Pty Ltd, 7 Grosvenor Place, Brookvale, NSW 2100; stocks are available now. (W.N.W.)

Specialised linear ICs

LINEAR INTEGRATED CIRCUIT APPLICATIONS, by G. B. Clayton. Published by Macmillan Press Ltd, London, 1975. Soft covers, 153 x 235mm, 269pp, many diagrams. Recommended retail price $12.50.

The main concern of this book is the operation and application of the specialised linear IC devices which have appeared in recent years; active filters, timers, modulators, four-quadrant multipliers, VCO's and phase locked loops. The operation of the devices themselves is analysed, and then a discussion given of their applications.

The text is concise and well-written, and is well served by diagrams. In short, then, a useful book on modern specialised-function linear devices and their applications.

The review copy came from the Melbourne office of the publisher, but we are advised that the book should be stocked by all major bookstores. (J.R.)

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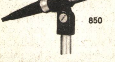

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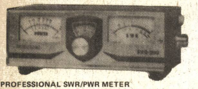

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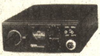

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The new IC22S transceiver is a PLL synthesised rig with programmable ROM for any frequency multiple of 25 KHz from 144 to 148 MHz. Simplex, duplex or reverse achieved by a flick of a switch on the front panel. This fabulous new rig features ceramic discriminator, IDC, electronic Tx/Rx relay, full swr protection and VICOM 90 day warranty. Circuitary includes 34 transistors, 7 FETs, 13 ICs and up to 128 diodes. Receiver sensitivity better than 0.4 uV for 20 dB quieting. Your new IC22S comes complete with mic, mobile mounting bracket, plugs, cables, spare diodes for programmable matrix and English Instruction Manual.

IC215 HANDY FM PORTABLE

This is ICOM's first FM portable, and it puts good times on the go. Change vehicles, walk through the park, climb a hill, the ICOM quality FM communications go right along with you. Long lasting internal batteries make portable FM really protable, while accessible features make conversion to external power fast and easy!

- Fully collapsible antenna
- 15 channels (12 on dial + 3 priority)
- Dual power 3 watts/40 mW
- Lighted dial and meter
- Crystals same as IC22 series

$199

Your new IC215 comes complete with 3 popular channels, mic, shoulder strap, connectors, batteries, English Manual and VICOM 90 day warranty.

QUALITY HANDY PORTABLES

IC202 $219 IC502 $219

The famous IC202 handy portable runs 3 watts pep with VXO control 144-146 MHz. Features noise blanker, RIT, lighted dial and meter, telescopic antenna and of course that ICOM quality! Comes complete with mic, carrystrap, dry cells, English manual and 90 day warranty.

Six metres SSB using the IC502 can be great fun! This handy portable runs 3 watts pep ssb 52-53 MHz. Featuring VFO control, suitchcable noise blanker, RIT and provision for external power and speaker, 9 long-life C batteries, English manual and 90 day warranty.

27MHz

BUILT-IN SWR BRIDGE!

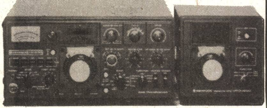
$159 COUGAR

COUGAR 23 B AM DELUX TRANSCEIVER

Delux mobile 23 channel (synthesised) for the quality conscious Novice. The Cougar features built-in swr meter, noise blanker, delta tune, rf gain control, mic gain control, built-in modulation meter, separate PA switch. Circuitary consists of 1 IC, 20 transistors, 18 diodes. RECEIVER: dual conversion, sensitivity 0.5 uV for 10 dB S+N/N, selectivity 6 dB bandwidth 5 kHZ, PA audio power 5 watts. TRANSMITTER: 5w input, spurious harmonic suppression better than 55 dB. Comes complete with mic, mobile bracket, dc cable and manual.

HAM GEAR SPECIALS

TS520 ~~$674~~ $650



TS820 ~~$940~~ $850

E.A. LOG BOOK packed with handy reference data including Australian & New Zealand broadcast frequencies, how to get verification cards, 27MHz frequencies, Q code etc. All this for $2.95 + P & P $1

ANTENNAS

BASE LOADED WHIP

Model M1 quality base loaded mobile whip, 40.5 inches long, 50 ohm impedance, vswr less than 1.5. Includes roof mount and optional boot lid mount, spring and coax with PL259 plug. $27 + P&P

Model G2 as above with gutter clamp $29.90 + P&P

HELICAL WHIP

Model HW-11S-6 6ft helical whip, covered in tough plastic, this top loaded (helical) is designed to give a perfect 52 ohm match. $22 + P&P

- – spring base $13
- – roof base $17.50

MARINE WHIP

Model HW-11-6M requires no ground plane and can be operated on fibreglass, wood surface or on mast. Comes complete with matcher, coax, PL259 plug. $65

HUSTLER CENTRE LOADED WHIP

Ideal mobile whip, mounts on bumper bar.

Whip	$19
Mast	$26
Bumper Mount	$19
Spring	$11.50

HALF WAVE GROUND PLANE

Model V1 vertical ground plane (half wave) gain 3.75dB, overall length 5.5m, mounting on mast tubing up to 1½" diameter. $49 + P&P

TRUCK ANTENNA

Twin 50.4" 50 ohm mirror mounted truck antenna. Complete with coax and PL259 plug. $42. + P&P

27MHz ground plane, superb quality, wound on strong fibreglass rod with teflon protection. $79

¼ wave high efficiency ground plane, solid 108 inch heat treated radials and radiator. Radials droop for 50 ohm match. Complete with S0239 socket. $35 + P&P $3

SWLs

BARLOW WADLEY

The famous portable Barlow Wadley Communications Receiver with crystal controlled reception of am/lsb/usb/cw:

Standard model	$319
With FM	$339

ANTENNAS

Listener-1 "V" type covers 3-30MHz with special trap for DX reception $22

Listener-3 long range wire dipole antenna 3-30MHz complete with balun, feed wax, VHF plug, insulators. Ideal for the serious SWL $49

SWL ANTENNA COUPLER

For matching receiver to the antenna line, this quality product handles signals from 2-30MHz with an output impedance from 50 to 600 ohms.

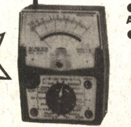
NEW

ON-AIR MULTI-TESTER

Built-in Multi Tester & Field Strength Meter

● CB, AMATEUR RADIO ● R/C GEAR ● MARINE, AIRCRAFT ● STEREO, Hi-Fi ● ELECTRONICS, OTHERS.

$39



Model OB-330

SPECIFICATIONS

Model OB-330 DC 20000/V AC 8000/V

TAUT BAND METER, METER PROTECTED

• DC V: 0 – 0.25, 0 – 2.5, 0 – 25, 0 – 100, 0 – 250, 0 – 500, 0 – 1000V • AC V: 0 – 10, 0 – 50, 0 – 250, 0 – 500V • DC mA: 0 – 50 μA, 0 – 5mA, 0 – 50mA, 0 – 500mA. • Ohm: 0 – 2KΩ, 0-20KΩ, 0 – 200KΩ, 0 – 2MΩ • Accuracy: ±3% at FS value on DC range/±4% at FS value on AC range/±10% at indicating value on Ω range. • Battery: 1.5V (UM-3) × 1 • Audio power: 0 – 12W, 0 – 300W at 8Ω Z line. 20Hz – 100kHz ±1dB • Field Strength Meter: 1.9MHz – 500MHz • Dimensions: 125 × 95 × 45 m/m • Weight: 330grs.

A licence is required for all transmitting equipment.

VICOM

Head Office & Mail orders–
139 AUBURN RD. AUBURN VIC. 3123. Ph: 82.5398

VICOM gear also available at:
Sydney: Jack Gilham, 23 Whiting Street, Artarmon. Ph: 439.1271
Canberra: Daicom Electronics, 29 Colbee Crt, Phillip. Ph: 82.3581
Adelaide: Graham Stallard, 27 White Ave, Lockleys. Ph: 43.7981
Perth. Netronics, 388 Huntriss Ave. Woodlands. Ph: 46.3232
Brisbane: Elite Electronics, 69 Wardell St, Dorrington. Ph: 38.4480
and a networkof Dealers throughout Australia. Dealer enquiries welcome.

The Amateur Bands

by Pierce Healy, VK2APQ

Spark gaps and crystal sets

Our first story this month is about an amateur licence issued in 1914, with a reproduction of part of the licence document. It is interesting from a technical and administrative point of view, emphasising the vast changes which have taken place in both over the years between.

To those interested in communicating by radio, be it the amateur service, commercial, or government services it could be enlightening to compare current licensing terminology and requirements with those of bygone days.

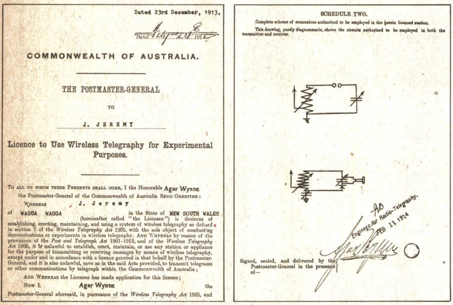
During a discussion recently with Mr Richmond Jeremy, manager of Hawker de Havilland Avionics Department, on current trends in electronics, he mentioned that his father, Mr J. Jeremy, had been one of the pioneer amateur operators in Australia while living at Wagga Wagga, NSW, in 1912. He also mentioned that among his treasured possessions was the original transmitting licence issued to his father in 1913. Richmond has kindly made available a copy of the documents and sections have been reproduced here.

Against the background of the novice amateur licence and its examination standards, the demands for a CB type service and the specifications now required for transmitting equipment, it is evident that many changes have taken place. There is no mention of examination requirements in the documents. However, it is apparent that a receiving licence was necessary, and operators had to be capable of sending and receiving Morse code at not less than 12 words per minute.

The text of the departmental letter dated 23rd December, 1913 contains interesting technical specifications of the transmitting equipment to be used. These may take a little understanding in view of the terminology.

The licence, a seven page document, is too lengthy to include fully. It contains eighteen clauses relating to regulations the licensee must observe, several being very similar to those currently in force. Some emphasis is placed on interference with telegraph lines of the Postmaster-General. The licence fee was twenty-one shillings for each year or part thereof.

It must be admitted that the opening address of the licence, in terms of old world graciousness is quite different and more personalised than present day bureaucratic methods.



Dated 23rd December, 1913.

8
Dated Feby 24 1914

COMMONWEALTH OF AUSTRALIA.

THE POSTMASTER-GENERAL

TO

J. JEREMY

Licence to Use Wireless Telegraphy for Experimental Purposes.

To all to whom these Presents shall come, I the Honorable Agar Wynne the Postmaster-General of the Commonwealth of Australia Send Greeting:

Whereas J. Jeremy of WAGGA WAGGA in the State of NEW SOUTH WALES (hereinafter called "the Licensee") is desirous of establishing, erecting, maintaining, and using a system of wireless telegraphy as defined in section 2 of the *Wireless Telegraphy Act* 1905, with the sole object of conducting demonstrations or experiments in wireless telegraphy. And Whereas by reason of the provisions of the *Post and Telegraph Act* 1901-1912, and of the *Wireless Telegraphy Act* 1905, it is unlawful to establish, erect, maintain, or use any station or appliance for the purpose of transmitting or receiving messages by means of wireless telegraphy, except under and in accordance with a licence granted in that behalf by the Postmaster-General, and it is also unlawful, save as in the said Acts provided, to transmit telegrams or other communications by telegraph within the Commonwealth of Australia;

And Whereas the Licensee has made application for this licence;

Now I, Agar Wynne the Postmaster-General aforesaid, in pursuance of the *Wireless Telegraphy Act* 1905, and

SCHEDULE TWO.

Complete scheme of connexions authorized to be employed in the herein licensed station.

This drawing, purely diagrammatic, shows the circuits authorized to be employed in both the transmitter and receiver.

Engineer for Radio-Telegraphy.
FEB 11 1914

Signed, sealed, and delivered by the Postmaster-General in the presence of—

Left: Portion of page 1 of the licence issued in 1913-14 to Mr J. Jeremy of Wagga Wagga. Right: Portion of schedule 2 which accompanied the licence, showing the circuits of the transmitter and receiver. No component values were given!

Judging from the letter dates, it took from the 24th November, 1913 until the 28th July, 1914 for the licence to be finally issued. But to be fair, a provisional licence had been issued within a month.

History—an interesting aspect of amateur radio so often overlooked.

Radio clubs and other organisations, as well as individual amateur operators, are cordially invited to submit news and notes of their activities for inclusion in these columns. Photographs will be published when of sufficient general interest, and where space permits. All material should be sent to Pierce Healy at 69 Taylor Street, Bankstown 2200.

WIA HEADQUARTERS NEWS

In a message to members, the federal president Dr David Wardlaw, VK3ADW draws attention to the 1977 WIA federal convention. (Actually held in Melbourne over ANZAC weekend.) Pointing out—"Whatever comes out of it is not history. It will be the policy of the Institute as a whole. In exactly the same way that the policy of the Institute derives from all past federal conventions.

"The federal council, made up of the seven state federal councillors with advice and assistance from the executive, meets each year at what is called the federal convention. This is where the guidelines of the Institute originate.

"The discussions which are carried on in the federal convention are centred on current amateur radio affairs. These come forward to the convention through the seven divisions as agenda items. The chairman of the federal convention can permit debate on other matters under what can be called general business.

"This is how the WIA as a whole makes up its collective mind. Whatever is decided by the federal council is going to affect every member in one way or another."

David urges members to read the report on the federal convention because—

"Unless you do you could become a mine of misinformation about the WIA."

WARC 79—The federal executive has produced a draft of background information which has been circulated to divisions. This sets out the amateur service as fully but as briefly as possible, its value internationally and locally, the great range of activities by amateurs, a very short historical precis, some reference to amateur radio's value in emergencies, the training of newcomers, references to interference of various kinds, a short appreciation of the amateur satellite service, and details of the frequency bands now allocated to Australian amateurs and suggested requirements in the future.

Compared to the last WARC, in 1959, the International Amateur Radio Union is much better organised and, recognising that amateur radio is a global activity, has prepared material in a model brief form for IARU member societies. This document was drawn upon by the APG Committee 2 in preparing the Australian government brief for WARC 79.

CALL BOOK: Contract details have been clarified and it may be available in August. Details of price and additional contents are yet to be finalised.

NSW Division: There were 19 candidates for the seven positions on the NSW Division council. The ballot papers were counted during the annual general meeting at 14 Atchison St, Crows Nest, on Friday 25th March, 1977. Elected were: Phil Card, VK2ZBX; Chris Jones, VK2ZDD; Henry Lundell, VK2ZHE; Ian Mackenzie, VK2ZIM; Tim Mills, VK2ZTM; Glen Molloy, VK2AGM and David Thompson, VK2BDT.

A motion was passed at the meeting for a subcommittee to be formed to revise the current divisional constitution.

At the same meeting honorary life membership of the WIA was bestowed on Keith Howard, VK2AKX, for his services to amateur radio.

Keith was the founder of the Westlakes Radio Club and for many years has been associated with training those seeking to become amateurs. In past years he has held office in the Hunter Branch, the NSW division, and on at least three occasions acted as official observer for the NSW Division at federal conventions.

His "Novice Licence Manual of Questions and Answers", published by the WRC, has become a best seller among prospective amateurs.

NORTH QUEENSLAND CONVENTION

The Townsville Amateur Radio Club will host the North Queensland Convention at Townsville on the 23rd and 24th July, 1977.

Activities at the convention will include:—

Hidden transmitter hunt

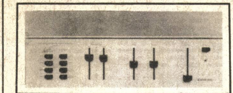
Competitions for the ladies

Displays of commercial and home built equipment

Swap and sell

RADFORD

High Definition Stereo Control Amplifier HD250



SPECIFICATION

Power output.
Rated: 50 watts average continuous power per channel, both channels driven, 4-8 ohms load.
Maximum: 90 watts average power per channel into 5 ohms load.

Recommended load impedance: Nominal 8 ohms loudspeaker.

Output source impedance: 0.1 ohms, in series with 2200 μF and 2μH.

Rated sensitivity.
Disc input: 2 mV at 1 kHz, RIAA equalised.
Line inputs: 100 mV, flat response.

Rated sensitivity is the input voltage required to produce rated output power with the channel gain (input level) control set to 0 dB and the volume control at maximum. This corresponds to 1 volt (0 dBv) at the pre-amplifier (line) output terminal.

Overload margin.
Disc input: 40 dB min.
Line input: 36 dB min.
Line output at clipping level: 18 V r.m.s. (+25 dBv) with power amplifier input disconnected.

Frequency response.
Disc input: RIAA deviation less than 0.5 dB (typically 0.2 dB) 50 Hz to 20 kHz (see Fig. 2). L.F. roll-off 12 dB/octave, −3 dB at 30 Hz.
Line input: 20 Hz to 32 kHz, −1 dB.

Hum and noise output.

	Condition (1)	(2)	
Disc:	−75 dBv	−80 dBv	Referred to rated sensitivity of 2 mV†
	−83 dBv	−88 dBv	Referred to 5 mV input
Line:	−80 dBv	−83 dBv	† see below.
	−85 dBv	−88 dBv	Input level controls at minimum
	−100 dBv	−104 dBv	Volume control at minimum
Signal-to-noise ratio at loudspeaker terminals:	97 dB	100 dB	Volume control at minimum

Note:
Condition (1) Measured flat with a 6 dB/octave roll-off at 15 kHz to provide a noise bandwidth of 23 kHz.
Condition (2) Measured with standard 'A' weighted characteristic.

† Noise is quoted as the voltage present at the line output terminal with the input level control set to 0 dB and the input short-circuited. As the noise is expressed in dB relative to 1 volt (dBv), the figures will also indicate the signal-to-noise ratio.

Tone control.
Bass: ±11 dB at 30 Hz } See Fig. 3.
Treble: ±12 dB at 20 kHz } See Fig. 3.

Rise time: 6μs.

Frequency response and rise time are measured at rated output power level, with the tone controls neutral or cancelled.

Input impedance.
Disc: 47 K ohms.
Line: Nominally 27 K ohms, varying with input level control setting.

Distortion.
Disc amplifier.
at rated level: Zero*
at +20 dB: Zero*
Line amplifier.
at rated level: Zero*
at +20 dB: Less than 0.01% at 1 kHz.

* Cannot be identified or measured as it is below inherent circuit noise level.

Power amplifier.
at rated output: Less than 0.02% (typically 0.01%) 1 kHz.
at 25 watts output: 0.006% at 1 kHz. (See Figs. 9, 10 and 11.)

Total harmonic distortion is quoted separately for the disc amplifier, line amplifier and power amplifier. Under normal operating conditions, the power amplifier will be the only contributor of distortion.

Mains input: 100 V, 120 V, 130V, 220 V, 230 V, 240 V, 50-60 Hz.
Size: 17" (43 cm) wide, 4½" (11.5 cm) high, 11" (28 cm) deep overall.
Weight: 21 lbs (9.5 kg).

For full details contact:

zephyr products

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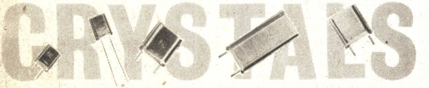

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BRISBANE. PHONE 47 4311

DILMOND INSTRUMENTS
HOBART. PHONE 47 9077

Forums on technical topics and policy matters relating to amateurs generally
Transmission of WIA news and callbacks.
Barbeque luncheon on Sunday
Inspection of installations of technical interest
Look, learn and do, handcraft for the ladies
Dinner and entertainment on Saturday night
Entertainment for children.

Visitors arriving on Friday are invited to meet informally on Friday night at the Townsville Aero Club for drinks and eyeball QSO. Dress is tropical-formal. Meet Bruce Hughes, VK4BZ and Chas Churm, VK4HO for introductions.

Dinner on Saturday night will be smorgasbord and dress will be tropical-formal. During the varied entertainment, prizes will be presented to the winners of the day's activities.

Registration will begin at 9am Saturday morning at Hermit Park State School.

Registration forms and details may be obtained from the convenor, NQ Convention, TARC, PO Box 964 Townsville QLD 4810. Registrations received up to 1st July will be eligible for the early registration prize.

Further details will be given over the VK4WIA news sessions at 0900EST each Sunday. Intending visitors are invited to join the VK4WIT net on 3605kHz each Sunday at 1945EST.

The official convention frequency will be channel 50 (146.5MHz) and repeater channel 2 will be operational throughout the convention.

Visitors from the cold southern states will be particularly welcome.

RADIO CLUB NEWS

FRANKSTON & MORNINGTON PENINSULAR AMATEUR RADIO CLUB: Here are details to be added to your radio club directory.

Meetings—Second and fourth Friday in the month
Time—8.00pm
Location—Monterey Technical School, Silvertop Crescent, North Frankston.
Secretary—Arthur Woodward, VK3NBX, PO Box 38, Frankston, Vic. 3199.
Club callsign—VK3BHU

WAGGA DISTRICT RADIO CLUB: Members participated in the John Moyle Memorial National Field Day from Mt. Tomuramma, in the Snowy Mountains, 1200 metres above sea level. A total of 4959 points was scored.

Free novice licence classes are conducted each Thursday night at the Wagga Police Boys Club by John Eyles, VK2YCM.

Recently club members provided a 144MHz link between Rescue Club boats during a raft race over a 20 kilometre course on the Murrumbidgee River. This event, whilst mainly of a safety nature, was a good opportunity to exercise WICEN equipment and procedures.

The WDRC plays an important role during the monotonously regular floods that occur in the area, providing communications between rescue boats and relaying river readings to SES headquarters.

The annual general meeting of the WDRC will be held on the 24th June, 1977.

ILLAWARRA AMATEUR RADIO SOCIETY:
VK2AMW MOONBOUNCE PROJECT: During the 12 months to March 1977, VK2AMW was scheduled for 48 EME tests and 11 CQ calling periods. Contacts were made with 14 different stations—W1JAA, K3PGP, W4WD, WB5LUA, W4NUS, VE4JX, JA1ATL, JA1VDV, F2TU, PA0SSB, LX1DB, SM5LE, FY7AS. It was also heard by a number of stations but not well enough to make two-way contacts.

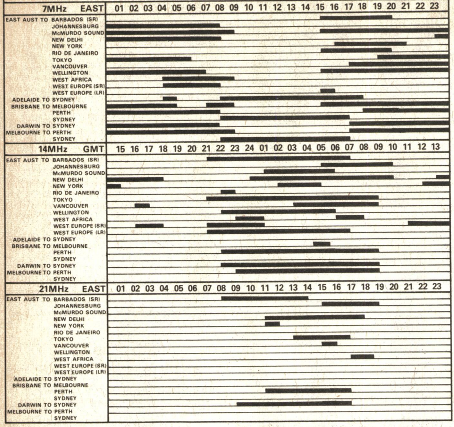
A total of 25 different stations in 10 countries have been contacted by VK2AMW on 432MHz, but as yet no Australian station has been contacted via the EME path.

A special test was conducted in May, 1976 with the Stanford University Research Group in the USA. Signals from their station, WA6LET, were the loudest heard during the year, 20dB peak above noise.

The most interesting experiments during the 12

IONOSPHERIC PREDICTIONS FOR JUNE

Reproduced below are radio propagation graphs based on information supplied by the Ionospheric Prediction Service Division of the Department of Science. The graphs are based on the limits set by the MUF (Maximum Usable Frequency) and the ALF (Absorption Limiting Frequency). Black bands indicate periods when circuit is open. 6.77



months were made during the almost total eclipse of the sun on 23rd October, 1976. VK2AMW echoes were received from the moon when it was directly in front of the sun. This allowed checks to be made on rotation of polarisation as signals passed through the ionosphere under these conditions. Measurements were also made of 70cm radio emissions from the sun's corona, as distinct from the sun's disc.

Frequencies in regular use are: 432.000, .005, .010, .015, .020, .035, .040, .045, .050 and 432.060MHz.

The VK2AMW moonbounce project has now been active for over seven years with Lyle Patison, VK2ALU as co-ordinator, ably assisted by Charlie Proctor, VK2ZEN.

Many visitors have been present during the tests. Anyone wishing to see what goes on during moonbounce tests, should pass a phone number to either Lyle or Charlie. The intending visitor will be contacted a day or two before a test weekend and advised as to the time schedules.

GOLD COAST RADIO CLUB: Due to generous support by members, donations totalling $270 were received for the repeater fund, thus saving a big drain on club funds.

It is reported that seven local illegal 27MHz operators are now attending the club's amateur licence classes, no doubt having realised that amateur radio has more to offer.

Details of classes may be obtained from the Secretary, PO Box 588, Southport, Qld. 4215.

WEST AUSTRALIAN VHF GROUP (INC): The March meeting discussed a proposed moonbounce project incorporating the group's station VK6WH.

It is also reported that the Wireless Hill Museum project has made further progress. This followed a recent meeting between the Museum committee and the Melville City Council.

GEELONG AMATEUR RADIO & TV CLUB: Enrolment for the novice licence course is 31, well exceeding the expected number of 20.

Classes are held each Tuesday and Thursday evenings. Tuesday is devoted to radio theory and Thursday has a one hour tutorial followed by one hour Morse code practice.

WESTLAKES RADIO CLUB: The 1976 IREE pennant for a non-school club has been won by the WRC. This is the fourth time this pennant has been awarded to the club; first in 1964, then 1965, 1971, and 1976.

Orders for "Novice Licence—Questions and Answers" by Keith Howard, VK2AKX, and published by the WRC, are running at 200 copies per week.

Copies are $3.00 each, posted anywhere in Australia. Remittance should be made payable to the Westlakes Radio Club, and sent to PO Box 1, Teralba, NSW 2284.

RADIO CLUB DIRECTORY

An invitation is extended to radio clubs to supply details for a Radio Club Directory in the 1977 Year Book.

Only details received between now and 1st August, 1977, will be included.

Please give details in the following format.

Club name:— ....
Club call sign:—..........................
Meeting place:— ....
Day and time:—..........................
Affiliation:— ....
Net frequency:— ....
Contact:—.................................

In past years this facility has been the means of publicising your club and assisting visitors and prospective members in your area.

Do not delay—write now.

S.M.
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P.O. BOX 19 DONCASTER EAST 3109
MAIL ORDER KITS

DIGITAL TACHO KIT
.5" High 7 Seg. LED display, P.C. board construction TTL IC's 10 RPM resolution, Will suit 4, 6, & 8 CYL. cars Accurate calibration, No equip. required, Circuit & assy instructions included.
4 DIGIT MODEL $48.50 POST FREE

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.5" High 7 Seg. LED Display, P.C. board construction, Battery powered, True random No. selection, Simple to build, Suit beginner or school project.
SINGLE DICE (1 display) $16.25 post free
DOUBLE DICE (2 display) $32.50

CAR BURGLAR ALARM KIT
E.A. Nov. 76. Protect your car with a small investment. Simple to build, Light flashes on & off when operating, Works on Batt. volts drop, Entry & Exit delay, 12 V. ONLY Pos. or Neg. earth $30.50 POST FREE

WINDSCREEN WIPER DELAY KIT
Suit 12V cars only, Delay .5 to 10 Sec, P.C. board simple to build, Full instructions supplied, Relay output, not suitable for PER. MAG. motors.
$18.75 POST FREE

TACHO KIT
Suit any 1 M/a meter movement, Simple to build, P.C. board construction, Suit beginner or school project, Based on I.C. chip, $9.50 POST FREE

DIGITAL STOP WATCH/TIMER KIT
.3" High 7 Seg. LED Display, 6 Digits, Crystal controlled .002% Accurate, read to 1/100 Sec. Batt. operated, P.C. board, Stop/Start can be remote controlled, Suits sports & industrial applications. $69.00 POST FREE

COMPONENTS SPECIALS
McMurdo flush mount rocker switch DPDT $1 EA. or 10/$7. 30 Amp OMRON relay 240V coil $6.50 EA. 1M/a Meters $6.50. 240V Neons 50c EA or 6/$2, 1000MFD 16V P.C. electros. 30c EA. or 6/$1.50. 100k pots 30c EA. or 6/$1.50. Varn. Cott Spaghetti ass. sizes 5x1M $1.50, FND500 Display $2 or 6/$11. DL507 Display $1.50, 555 IC's 80c or 10/$7. Slide sw. DPDT 5/$2, MIN. trim pots ass. 10/$3, 1N914 diodes 10/$1. Resistors .5W $2.50/100 of each. Red LEDS 10/$3.00.
$5.00 MIN. Order for components only. POST FREE

S.M.
ELECTRONICS
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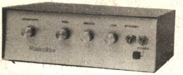
CROWS NEST, N.S.W. 2065

136 VICTORIA RD., MARRICKVILLE, NSW 2204 **PHONE 51-3845**

A.C.E. RADIO

MUSICOLOUR

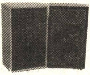


For the disco, light show, party, nites, or just relaxing . . . enjoy your records and tapes more with the new magical Musicolour Organ. Simple tc connect to the home stereo or P.A. system. 3 channels, 1500 watts max. load each.

Fully constructed, ready to operate, **$75.00**

Complete kit of top quality parts and instructions for the models 11 or 111 **$55.00**
P.P. NSW **$3.50**, interstate **$5.50.**

30 WATTS OF EXCELLENT HI-FI WITH PLAYMASTER LOUDSPEAKER SYSTEMS



3-41L. As described in June '76 E.A. Again features the mighty 8-30 woofer, with the advantage of the new Magnavox 6-25 midrange, and the more elaborate cross-over network. The dome tweeter is Philips AD0160/T8. Beautiful teak, or the ever popular walnut veneer cabinets are available. Either system can be carefully packed and despatched per airfreight passenger rail or road. Packed weight approx. 40kl. pair.

Fully finished teak or walnut cabinet only. **$38.50 ea.** **$96.00 each**

HI FI CABINET KITS

Do it yourself—big savings. Our kits are extra easy to finish. Top, bottom, each side and back are factory assembled, baffle is pre-cut. Veneered pyneboard. Teak or walnut. Complete with innerbond and speaker grille cloth. 8-30 3-45L. systems. **$55.00** pair.
MV-50 system **$69.95** pair.

FAMOUS MAGNAVOX AUST. MADE LOUDSPEAKERS

MODEL.	Imp	Watts. Rms	Reson. Hz	Freq.Hz	V.C.Dia.	Price	P.P
10-40 10"	8	40	45	30-8000	1½"	**$23.00**	$2.50
8-30 8"	8	30	45	30-8000	1½"	**$19.00**	2.25
12WR 12"	8	16	45	30-16000	1'	**$16.50**	2.00
10WR 10"	8	16	45	30-16000	1"	**$13.90**	2.00
8WR 8"	8	16	45	30-16000	1"	**$11.80**	2.00
6WR 6½	8	12	45	30-16000	1"	**$10.90**	22.00
6.J 6½	15	8	85	80-7000	1"	**$8.50**	1.50
6-25 6½	8	25	45	45-6000	1½"	**$16.50**	2.00
XJ3 Dome	8/15	25	1500	2000-20000	1	**$8.95**	1.30

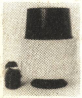
WESTON MARINE C-B TRANSCEIVER (PMG approved)

Auto noise limiter, squelch A.G.C. overmod limiter. Low pass filter for bandwidth. SPECS T-mitter. Crystal locked. 5 watts input to RF stage Freq. coverage. Any 11 channels in 27 MHz band. Receiver crystal locked double superhet. 6.5 MC and 455 Kc 1fs 3" speaker, dynamic mic. 50 ohm antenna. 20 t'sistors, 8 diodes 12 VDC operation. Sensitivity. 0.5UV 10dB. S/N Size 6½" x 2½" x 7¾" Wt. 4½ lbs.
Price **$159.95** P.P N.S.W. $4.50 Interstate $5.50

20 WATT STEREO AMPLIFIER CHASSIS

Update your stereo system with a hi-fi 10 watt RMS per channel amplifier. Small and compact 85 x 145 x 45 mm.h. Fully assembled—ready to operate. Easy to install in radiogram cabinet, record player base, etc. 240V 50Hz power transformer included. Circuit supplied individual heatsinks for power transistors.
SPECIFICATIONS. Power Output 10 + 10 WRMS, at 8 ohms. Output Imp 8-16 ohms. Distortion. Better than 0.5% Freq. Response. 35-18000Hz. Sig. to noise. Better than 50dB. CH. separation. Better than 50dB. Input sensitivity. 500mV. Bass control ±10dB at 40Hz. Treble control. ±10dB at 12000Hz. Power supply. 28-0-28V. 1amp. Dim 185 x 145 x 60mm. **$29.95** Pre-Amp for magnetic cartridge **$10.00** extra. P & P $3.50.

RED ROTATING DISTRESS BEACON



12VDC
9.95

240 VAC
$16.95

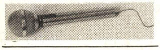
Now available with transformer and rectifier for mains operation. Great safety feature for car or boat. Used extensively in Discos.
P.P. $1.50 interstate $2.50.

27 MHz Hi Gain Ringrod Base Station Antenna

Fully collapsible, no tools or ground plane required. 6.875 mtres. High, 52 ohm feed point, wide band, gain 3dB. SWR. 1.5 or better. **$56.95 F.O.R.**
7 strand stainless steel aerial guy wire, 600 LBS, B-S Polythene covered. 40c per metre.

FM WIRELESS MICROPHONE

Cardioid Electret condenser type. Transmitting freq. range. 88-106MHz. freq. dev. + 75KHz. Field S, 50uV/MAT 50ft. **$24.95** p.p. 80c



AWA E-TONE 60 WATT RMS LOUDSPEAKER

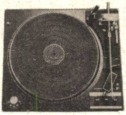
30CM (12") 8 AND 15OHMS VC DIA. 5.1CM BIG 3KG MAGNET. FREQ. 40-7000 Hz FOR BASS GUITAR. ORGAN GUITAR WEIGHT 4.5 KG. **$49.00.** P.P. $3.50

SANYO CADNICA RECHARGEABLE BATTERIES

Type A. $2.50EA.	4 for **$9.00**
Type C. $4.10EA.	4 for **$14.75**
Type D. $5.00EA.	4 for **$18.00**

P&P. $1.00 I State $1.75.
SANYO NICAD BATTERY CHARGER. **$25.95.** P&P $1.60

GARRARD MODEL 82



$57.00.

A superb 3 speed transcription changer/player. Auto/manual operation 4 pole magnetically shielded syn. motor. Resiliently mounted. Counterbalanced. Elegant tone arm with slide-in cartridge carrier calibrated. Antiskate. 265mm (10½"). Aluminium platter. Cue and pause control. Cartridge tilting lever. Magnetic cartridge diamond stylus. Size 375 x 335 x 170mm (14¾" x 13¼" x 6¼") 4.5kg (10 lbs) P & P $2.50. Interstate $3.50.

GARRARD CHANGER/PLAYER

MODEL—6400 3 speed auto manual changer—player 2 spindles. Motor 2 pole 240V 50Hz 10½" turntable cue and pause, tubular section pick up arm, Sonatone cartridge, Great value **28.50.**

Teak or Walnut pre-cut base and fully moulded, tinted perspex cover complete with hinges suits either model. **$29.95** p.p. $4.50 interstate $5.50. Base only **$14.95.** Cover only **$14.95.**

PLAYMASTER FORTY/FORTY STEREO AMPLIFIER

Kit of top quality components with c-core transformer. **$99.95** p.p. $3.50. Interstate $5.50.
Kit available with assembled and tested printed circuit board for **$12.00** extra.
Fully constructed ready for operation 40/40 **$130.00**

PLAYMASTER 25 + 25 STEREO AMPLIFIER

Complete kit of top quality parts with instructions **$87.50**
P.P, N.S.W. $3.50. Interstate **$5.50**

CLEARANCE SALE PANEL METERS

Clear plastic removable covers. Type MRA-38. 42mm. Sq. Bar. Dia. 38mm V-U. 500VAC, 10amp DC. 500ma. **$3.75** ea.

Type MRA-45. 50mm sq. bar. dia. 45mm. 50ua. 250ua. 500ua's' meter. 500ma. 100ma. 1amp DC. 500 vac. v-u. **$4.75** ea.
MRA-52. 70mm. sq. bar. dia. 52mm. 1 amp. DC. 500ma. v-u. 500 VDC. 10amp. DC. **$5.50** ea.

MRA-70. 85x78mm. bar. dia 70mm 10ma v-u. 50ma. 100ma. 500ma. 1amp DC **$6.50** ea.
MRA-85. 100mm. s. bar dia 85mm. 1ma (no scale) 30 amp. DC. 10ma. 1amp DC. v-u. 500VAC. 500VDC **$7.50** ea.

MICROPHONE STAND

Professional quality. 6ft floor model, retractable to 3ft. Heavyweight cast iron base **$25.00.** Freight extra.

DIFFUSES

Speaker cover plates (or exhaust fan) for ceiling or wall mount. White heavy duty plastic 8" round **$3.50**, 6" round **$3.00.** P.P. 90c.

STEREO HEADPHONES

8 ohms with volume controls 30-18000Hz **$5.75** P&P $1.25.

SUPER SPECIALS

500pF. 3KV compression condensers **75c**/ 60pF. 200pF, 415pF. per section 3 gang var. condensers **$1.50.** 2-¾" 8 ohm speaker **75c.** 2 core 23/0076 250VAC 7.5A. Power cable. Black PVC sheathed. 20c per yd. **$12.00** per 100 yds. New valves. 4GK5, 7GS7. **10 for $3.00.** 6BM8. 6GV8. **6 for $3.00.** 6.8pF polyester capacitors, ideal for crossovers. 90c ea. **2 for $1.60.** Spring loaded speaker terminal panels, red and black. 2 pole **$1.35** 4 pole **$1.55.** Cross over chokes. 2Mh **$1.65.** .3 and .5Mh **$2.00.** 1Mh **$2.50.** PL-259 coax plug for ¼" cable. **95c.** For ½" cable **$1.25.** Coax socket **90c.** Printed circuit board 12" x 5" **$1.00.** TV splitters. 750ohm in. 1x75 ohm and 1x300 ohm out. **$3.95** Red LEDs 10 for **$2.00.** Double sided mini tag strip **$2.75 ft.** 1" thick black plastic foam for speaker front panels **$1.00** sq. ft. .1 630V Ducon styro seal capacitors. **10 for $2.80.** .047 630 V. **10 for $2.00.** 240/240 60ma isolation transformer **$3.50.** 200-0-200 centre zero edge meter **$2.50.**

ADD. P.P.

AWA TV SPARES

Brand new. Guaranteed. Type 310 CF84A 12" CP/110 B/W picture tube **$9.50.** P.P. $3.50. Matsushita 13CH solid state tuner **$8.00** P.P. $1.00. 13CH. Valve tuner, (6GK5, 6G57) **$2.00.** pp. $1.00. 2SD200 horiz. output transistors, **10 for $3.00** p.p. $1.00

8-TRACK BLANK RECORDING CARTRIDGES.

Low noise professional quality polyester tape. Guaranteed. Recording time 38 mins. **10 for $7.99.** P.P. $1.50. Interstate $2.50.

PLESSEY ROLA SPEAKER SPECIALS

Model	Imp	Watts RMS	Reson. Hz	Freq.-Hz	Price	P.P.	Int' state.
C8MX	15	10	45	35-20000.	**$6.50**	$1.00	$1.50
C8MX	8	10	35	35-20000.	**$8.50**	$1.00	$1.50
C80D	8	20	45	35-8000.	**$11.00**	$1.50	$2.00
C12PX	8	30	40	35-13000.	**$16.50**	$2.50	$3.50

MULTI FUNCTION TV GAMES

SCOOP PURCHASE TOP BRAND.

Locally made. Guaranteed. 6 fantastic games including two gun games. Variable ball angles. Immediate on-screen scoring. Different sounds for each game. Adjustable bat size. Fast or slow speed ball control. Manual or auto serve. Operates with any TV set. **$49.95** p.p. $2.50.

WE REGRET THAT PRICES ARE SUBJECT TO CHANGE WITHOUT NOTICE.

Shortwave Scene

by Arthur Cushen, MBE

Radio Nederland plans to reduce the length of its transmissions from 80 minutes to 50 minutes from November, according to a tentative schedule received from the station.

The present transmissions from Radio Nederland to Australia and New Zealand are carried via the Bonaire relay station in the Caribbean with two transmissions in English 0630-0750GMT on 9630 and 0800-0920 on 9715kHz. At the same time, the first transmission in Dutch is on 9715kHz and the second transmission on 9770. The interference suffered from Radio Havana Cuba on 9715kHz continues, but an appeal has been made to Havana to move to another frequency.

Holland is planning to reduce the programs to a 50 minute duration from November, which would offer an opportunity to transmit programs on more than one frequency. The following schedule is envisaged: 0630-0720GMT Dutch for New Zealand on 9715 and 9630kHz; 0730-0820 English for New Zealand and Australia on 9770 and 9715; 0830-0920 Dutch for New Zealand and Australia on 9770; 0830-0920 English to New Zealand and Australia on 9715kHz.

Such a new schedule would allow broadcasts via Bonaire and Madagascar through two parallel transmitters, with the exception of the Dutch and English broadcasts to Australia. Maintenance of transmitters and power station make it possible to start before 0800GMT. The schedule would include one transmission through Madgascar to the Western part of Australia, from 1030 till 1120GMT on 17860kHz, running parallel with a transmission to East Asia on 15165kHz. This is a Dutch language program only. All transmissions are from Bonaire for Australia and New Zealand between 0630-0920GMT.

SURINAM BACK ON SW

Radio Surinam has been heard on short-wave after last being heard in 1961. The station is operating on 4779kHz and has been heard at 0331GMT sign-off. Signals have been noted by Ray Crawford, Invercargill, New Zealand from 0845 with programs in Dutch, Hindi, and Indonesian. An English announcement was heard at 0945GMT addressed to DXers, and giving full station details.

In New Zealand we are also hearing the medium-wave station of Surinam on 725kHz, which now has the power of 50kW. Broadcasts have been observed from 0845GMT when the program is in Indonesian. The station is located in Paramaribo, Surinam.

CONVENTION POPULAR

The Christchurch Convention, an annual event of the New Zealand Radio Dx League, was attended by the biggest contingent of overseas visitors yet, with members from all states in Australia except Western Australia. Those present included Keith Barton, Adelaide, Editor of DX Post; John Newman, Tasmania; Harry Weatherley, Melbourne; Chris Martin and Jack Buckley of Sydney; and Ernie Moore of Brisbane. Norm MacGuire from Hawaii was also present.

Keith Clover from Radio Australia proved a most interesting guest and took part in many activities, including the auction, visit to Akaroa and the Ferrymead Historic Park. Members from throughout the country were also present at the Godley Heads site, away from the city, and the remoteness enabled interesting medium-wave reception.

Norfolk Island on 1570kHz with 50W was received during a special broadcast, while excellent long path reception from European stations on medium wave was heard, with signals being received at 0430GMT, two hours before local sunset.

NEW VENEZUELAN SIGNAL

A new Venezuelan signal has been noted on 6190kHz at 1100GMT and at that time full station announcement is given. This is a new outlet for Ecos del Torbes, which is well known for its transmissions on 4980kHz using the call sign YVOC. The new outlet on 6190 has the call sign YVPC and is listed as using 1kW. The station address Apartado 152, San Cristobal, Venezuela. The signal on 6190kHz is fair, but there is some interference from a transmission from the USSR using the same frequency.

VILNIUS EXTENDS SCHEDULE

Radio Vilnius in Lithuania, USSR, has extended its schedule and now broadcasts daily to Europe and North America according to the BBC Monitoring Service. The broadcasts are 2200-2230 in Lithuanian and 2230-2300 in English, both on 6100kHz for Europe. The transmission to North America has English 2300-2330 to the Americas on 6150, 7215, 7245, 7400, 9610, 9800, 11690 and 15100kHz. A further transmission to North America, this one in Lithuanian, is broadcast 0100-0130 on 7150 and 7215kHz. According to the BBC, several of the frequencies used at 2300GMT have not been heard though all these channels have been announced.

KABUL ON 15230kHz

Radio Kabul in Afghanistan has been noted on the new frequency of 15230kHz at 1130GMT. The station opens with announcements which indicate that the transmission is beamed to Europe. At 1130GMT, the transmission opens with a news bulletin and the program is broadcast for 30 minutes. At 1200GMT a program in Pushto and Dari are broadcast to 1300GMT. This new frequency replaces 15195kHz which still carries the broadcast in Russian at 1030GMT and in German at 1100GMT.

ENGLISH FROM TAIWAN

The Voice of Free China, broadcasting from Taipah, is heard with an English news bulletin at 2200GMT on 17890kHz. This new time for the transmission, which is directed to North America, Australia and New Zealand, replaces the former broadcast at 1700GMT. The new transmission opens at 2140GMT and is transmitted on 9685, 11825 and 17890kHz.

LISTENING BRIEFS

EUROPE

FRANCE: Radio France International began broadcasting in French to Central and Eastern Europe recently. The service, a relay of France-Inter with special announcements in French at five times to the hour, has been observed on 5720, 7135, 7280, 7295, 9595, 9610, 11715, 11805, 11810, 11825 and 11855kHz in the period between 0500 and 2000GMT, according to the BBC Monitoring Service.

EAST GERMANY: Radio Berlin International now broadcasts in English to Asia according to DX Digest of Calcutta. Broadcasts are 0645-0730GMT on 17700 and 17740kHz; 1200-1245 on 15115, 17880 and 21540kHz; 1400-1445 on 17880 and 21540kHz; 1500-1545 on 17880kHz.

HUNGARY: Radio Budapest has been heard on 7275kHz with a broadcast in Turkish 0700-0900GMT on Sundays. This frequency replaces 7215kHz. Another new frequency 9655kHz has been heard at 2030GMT and has been blocked at 2100 by Athens, Greece, using the same frequency.

WEST GERMANY: Deutsche Welle broadcasts a DX Session in both English and German on the second Saturday of the month. The transmissions include 0740GMT on 6075 and 9545kHz; 1140GMT on 9615, 11795 and 15225; and 1540GMT on 6075 and 9545kHz.

PORTUGAL: According to the latest schedule received from Lisbon the English broadcasts are 0300-0330GMT on 6025, 11935; 1400-1430 and 1600-1630 both on 17895; 1800-1830 on 15340; and 2030-2100 on 6025kHz.

ASIA

THAILAND: Radio Bangkok provides fair reception on 9655kHz with English news at 1100GMT. On Mondays, at 1115GMT, letters from listeners are answered.

USSR: Radio Tashkent has been heard by one of our readers, Michael C. Power, Mt Gravatt, Q., at 1200GMT. The broadcasts are carried on 5975, 6025, 9540 and 9600kHz. The transmission is repeated at 1400GMT with fair reception on all frequencies.

SRI LANKA: The SLBC at Colombo has been heard on 11955kHz at 1900GMT with a news bulletin in English. Arthur Kindell of Levin, NZ, reporting in the New Zealand DX Times, states that the frequencies of 7120 and 9720kHz are also announced but were not heard.

Notes from readers should be sent to Arthur Cushen, 212 Earn Street, Invercargill, NZ. All times are GMT. Add 8 hours for WAST, 10 hours for EAST and 12 hours for NZT.

FAST DESOLDERING SAFE with EASY Soder-Wick

Soder-Wick is a specially treated copper braid which soaks up molten solder like a sponge. Desolders a P.C. pad in a second or so: acts as a heat sink to protect circuits and components.

1. Hold Soder-Wick on termination with hot soldering tip. Wicking action soaks up solder.

2. Remove tip and braid. Termination is left clean and free of solder.

In a range of sizes from your wholesaler or

ROYSTON ELECTRONICS

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RE475

FREQUENCY METERS AND CRYSTAL CALIBRATOR

TS-323/UR with spares Ex U.S. Navy. Bureau of Aeronautics brand new. 20 to 450 m/HZ. Accuracy of 0.01 per cent. Battery operated. Two a. batteries 6 volts three b. batteries 4SV.(135V) not supplied. AC power requirements. 240 VAC to 150 volt stabilised DC and 6.3 volt AC. AC Power pack not included

PRICE **$90.**

$2 Cartage to rail. Freight payable at nearest attended railway station.

P.M.G. TYPE TELEPHONES

Standard desk type with magneto bell calling device. Range 30 miles. Uses standard batteries at each phone. Any number can be connected together on single line.

$35.00

(2 TELEPHONE SETS)

$2 Cartage to Rail. Freight payable at nearest attended Railway Station.

FOUR CHANNEL VHF TRANSCEIVER

125 to 140 M/hz. 28 volt DC operated AM single crystal locks both TX and RX on same channel complete with generator.

$33.00

EX ABC MAGNETIC RECORDING TAPES ¼"

PROFESSIONAL QUALITY

5" x 600'	**$1.50**
7" x 1200'	**$2.75**
10½" x 2400'	**$5.95**

P&P A. $1.10, B. $2.00, C. $2.25, D. $2.25

ILFORD 17.5 mm SPROCKETED MAGNETIC TAPE

1000 ft reels brand new original packing **$4.00 ea.** quantity available

Post A $1.30, B $2.00, C. $2.30, D. $2.80

No. 62 TRANSCEIVER

With headphones, accessories etc

$60

TELEPHONE WIRE

1 mile twin (2 miles) genuine ex-Army Don 8 perfect condition $35 per drum $2.00 cartage to rail freight payable at destination.

PRISMATIC COMPASSES

Genuine ex-army Mk 3, liquid damped, as new $45.00 P & P A. $1.70, B. $2.25, C. $2.40, D. $2.65.

MORSE KEY
$1.75
Post 40c

MORSE KEY BUZZERS
$4.25
Post 60c.

DYNAMIC TRANSISTOR CHECKER

Provides a visual indication of signal output. Tests: electrode open circuits, short circuits, current gain. **$18.20 ea.**
P & P A$1.70, B$2.25, C$2.40, D$2.65

MULTIMETER

A compact and handy tester for workshop or lab where quick circuit checks are required

DC Volts 2.5 to 1.000V (20.000 OHMS per volt) AC Volts 10 to 1.000V (10,000 OHMS per volt) DC Current 50 UA 25 MA 250 MA. Resistance 40 K OHM, 4 MEG OHM Decibels minus 20 DB plus 62 DB complete with instructions only **$24.20** Ea. P.P. $1.05. Multimeter similar to above 30,000 OHMS per volt **$29.50** P.P. $1.05.

Only **$17.25** ea Post $1.05

BENDIX PIONEER

Drift Sight
Type B3
$250.00

4 DIGIT RELAY COUNTERS

50 volt DC, suit slot car Lap counters, etc.

$1.25 each. P & P 60c.

NIBBLING TOOL

Cuts sheet metal like a punch and die, trims, notches and cuts to any size or shape over 7/16inch.

ONLY **$12.50**

Post $1.10

NIFE CELLS

1.2 Volt, fully charged, 4in x 3in x 1in 4 AH.

$1.50 each. P & P 80c.

5" CRO TUBE 5 BPI $5.50 each.

Post A. $1.40, B. $2.25, C. $2.70, D. $3.45.

HANDY SIGNAL INJECTOR

Produces an Audio Signal in rich harmonics. Ideal for Sig Tracing in A.F., I.F., and R.F. circuits. Powered by 4 Penlight Batteries with On-Off Switch and indicator lamp. Size 1½" Diam. 5" Long. Only

$6.95 Post $1.10

522 Transceivers 100 150M CS

$35.00

POSTAGE KEY:

A: NSW.
B: Vic, Qld, SA.
C: NT, Tas.
D: WA.

VALVES

BRAND NEW

		6BM8	**$1.80**
		6GV8	**$1.50**
65N7GT	**95c**	CV850	**$1.50**
5U4G	**95c**	1H6G	**75c**
EF50	**75c**	832	**$5.00**
5Y3	**$2.25**	6X4	**$1.80**
2 x 2	**75c**	VR65	**75c**

P & P 40c

ARTILLERY DIAL SIGHTS MK2

Can also be adapted as a Dumpy Level or as base for a telescope has full 360° 5½" diam. gunmetal rotating circle. Adjustable elevation and depression. Has top grade ¾" diam. object lens. F.L.10" with cross hairs, eyepiece, ½" right angle prism.—height 10"—weight 3½kgs. With leather carrying case. Original cost $300.
Our Special only **$27.50**
P&P A. $1.95, B. $4.25, C. $5.90, D. $5.90

ZOOM SPOTTING SCOPES

30 x 30
LENGTH 12½", HEIGHT 10"
WEIGHT 1¾ lb.
$27.50

45 x 40
LENGTH 16",
HEIGHT 10"
WEIGHT 2 lb.
$39.75

High grade coated lenses. Ideal for pistol and rifle ranges or general viewing. Zooms in from very low to high powers. Complete with tripods.

POST: A. $1.70, B. $2.25, C. $2.40, D. $2.65.

TELESCOPES

25 x 30 **$7.95**

P & P A. $1.70, B. $2.25. C. $2.40 D. $2.65.

SPY TELESCOPES

8 x 17 mag size of a rifle cartridge extends to 8". Only **$5.95** each, post 60c.

BINOCULARS

PRISMATIC Coated Lenses. Brand new. Complete with case.

8 x 30	**$34.50**
7 x 50	**$39.50**
10 x 50	**$41.00**
12 x 50	**$42.50**
20 x 50	**$47.50**

P & P A. $1 80, B. $2.50, C. $2.20, D. $3.20

SMALL CLIP-ON POCKET TELESCOPE

15X **$5.20** Post 60c

RECEIVER No. 210

2-16 M/cs **$65.**
Transmitter No. 11 suits 210 **$35.**
24 volt Power supply to suit above **$15.**
Or complete station with Headphones, Mic, Morse Key, Antenna **$110.**

SOLENOIDS

Plunger Type 12V 300MA. Suit electric camera control, miniature trains, radio. etc.

$2.50 P & P 20c

200 MA 24 volt, ⅛in push movement.

$2.50 P & P 20c.

SELSYN MOTORS MAGSLIP

RECEIVERS 2" MK2 $5.50

TRANSMITTER 3" MK2 $15.00

Post Packing A. $1.75 B. $2.75 C. $2.75 D. $3.65

3000 TYPE RELAYS

P.M.G. 200Ohms — 1'500Ohm
Coils **$2.50** each. P & P 60c.

P.M.G. TYPE KEY SWITCHES. 75c P & P 20c

Cossor Double Beam Oscilloscope 1035. Tested. **$150.00**

CONDENSER LENS

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INFORMATION CENTRE

ANCIENT VALVE: I am seeking a replacement for a UY224 valve from a 1934 receiver. Is there a substitute and, if so, what is it? (Mr L. Wyatt, 46 Arthur St, Wellington, NSW, 2820.

● We don't like your chances, Mr Wyatt. The only reasonable substitute would be a type 57, itself a vintage type, and probably just as hard to locate. It would also involve a change of socket. However, we have taken the liberty of publishing your full name and address in case any reader can help you.

MODULAR DIGITAL CLOCK: I am writing to tell you about a feature that was not mentioned in the article in the December 1976 issue about the MA102B clock module. Recently I purchased one of these modules, and on reading the data sheet supplied with it, I found in the clock diagram a "hold" feature, for freezing the time so as to enable the clock to be set exactly.

I have since found that by switching the seconds display on, while at the same time depressing the slow set momentary contact switch, counting will cease, with the time display frozen.

I thought that you might like to take note of this information, and possibly publish it for the benefit of other readers. (M.K., Bracken Ridge, Qld.)

● Thank you for the information, M.K., which as you can see, we have published for the benefit of other readers.

Notes & Errata

ELECTRONIC STEAM WHISTLE (October 1972 and Projects & Circuits, File No. 3/MS/36): Wiring diagram, whistle and noise generator board (TR3, TR4). There is a link missing between two tags on the upper run of this board. It is from the opposite end of the 47k resistor connected to the emitter of TR4 to the tag immediately to its right.

OPERATION ELECTRONICS: The prices given in the February article for the Manual and Ideas Box have been revised. Price of the manual is $6.95; the Ideas Box $49.50.

AMATEUR REPEATER CHANNELS (Electronics Australia Log Book): The following repeater should be added to this table. Bendigo. Call Sign: VK3ARM. Channel: 4. Watts ERP: 40. Time-out: (Min.) 2.5. Ident Mode: FSK. Height ASL(M): 305. Range (km): 95. Site: Mt Alexander. Sponsor: Midlands Zone WIA. Status: Operational.

VIDEO DATA TERMINAL (February 1977, File No. 2/CC/17): The 1000uF electrolytic capacitor feeding the negative power supply voltage doubler, is shown with reversed polarity in the circuit diagram of Fig. 5. Also the PC board wiring diagram of Fig 6 has the keyboard scanning "X" lines labelled in reverse order. X9 is that connecting to pin 4 of the encoder IC, X2 that connecting to pin 5, and so on.

RTTY TERMINAL (March 1977, File No. 2/MS/43): On the overlay diagram for the printed circuit board on page 48, the collector and emitter designations for the BC558 and BC548 transistors used as emitter followers have been shown reversed.

VOX RELAY (April 1977, 1/RA/33): The source of the Science Fair kit No. 28-131 was not stated in the article. These are being marketed through the Tandy Electronics chain of stores.

MINI SCAMP MICROCOMPUTER (May 1977, File No. 8/M/13): In the wiring diagram for the power supply shown on page 81, the lead from the 12.6V transformer tap is shown as being earthed. It should not be earthed, but should connect only to the 1000uF capacitor.

RADIO PARTS GROUP: The Panther and Fairmate CB transceivers advertised by this firm in the May issue on page 105 are now out of stock. However, the firm advises that they are able to supply Kraco SSB and PACE CB-144 transceivers, offering more features, for the prices advertised.

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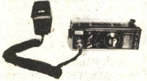

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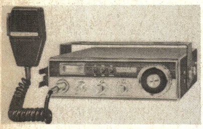

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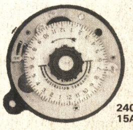

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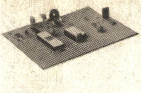

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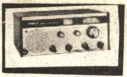

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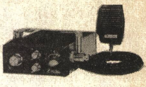

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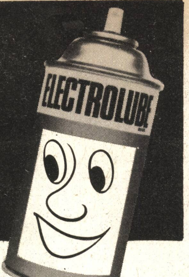

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89	10	5670	0-12-15-20-24-30	23.75

50 Volt Range: Primaries 220-240 volts
Voltages obtainable: 6, 7, 8, 10, 14, 15, 17, 19, 21, 25, 31, 33, 40, 50, or 25-0-25.

Ref.	Amps	Wt.	Secondary Taps	$
102	0.5	737	0-19-25-33-40-50 V	8.78
103	1	1304	0-19-25-33-40-50 V	11.40
104	2	2495	0-19-25-33-40-50 V	12.87
105	3	3176	0-19-25-33-40-50 V	14.88
106	4	4100	0-19-25-33-40-50 V	18.13
107	6	5444	0-19-25-33-40-50 V	24.00

60 Volt Range: Primaries 220-240 volts,
Voltages obtainable: 6, 8, 10, 12, 16, 18, 20, 24, 30, 36, 40, 48, 60, or 24-0-24, or 30-0-30.

Ref.	Amps	Wt.	Secondary Taps	$
124	0.5	737	0-24-30-40-48-60 V	8.35
126	1	1361	0-24-30-40-48-60 V	9.38
127	2	2495	0-24-30-40-48-60 V	13.06
125	3	4083	0-24-30-40-48-60 V	17.97
40	5	5670	0-24-30-40-48-60 V	23.22

Miniature transformers with screens: Primaries 220-240 volts

Ref.	MA	Wt. Gms.	Volts	$
238	200	85	3-03	5.00
212	1A, 1A	595	0-6, 0-6	7.23
13	100	113	9-0-9	5.00
236	330, 330	198	0-9, 0-9	5.00
207	500, 500	566	0-8-9, 0-8-9	6.58
205	500, 600	1077	0-15-20, 0-15-20	8.20
214	300, 300	623	0-20, 0-20	6.50
221	700 (DC)	737	20-12-0-12-20	8.68
206	1A, 1A	1304	0-15-20, 0-15-20	11.75
203	500, 500	822	0-15-27, 0-15-27	10.26
204	1A, 1A	1417	0-15-27, 0-15-27	13.14

Battery Charger Types: Primaries 220-240 volts, Secondary 2v, 6v, 12v DC. (Rectified)

Ref.	AMPS	Wt. Gms.		$
45	1.5	737	Please note, these	9.10
5	4.10	1474	units do not	10.52
86	6.0	2608	include	13.62
146	8.0	3175	rectifiers	15.00
147	10	4082		18.00

Prices do not include postage or packing. Assess postage to your address using weights given and add 10% of postage rate for packing. Unless quoting sales tax number add 15% to order cost.

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THE RESEARCH — More than twenty years ago, Maxell produced their first reel of magnetic tape. At that time, Maxell made a commitment to produce and sell only the finest magnetic products their technology could create.

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2

THE TAPE — This continuous research has lead to the development of the Maxell UD (ultra dynamic) cassette. A tape that has a coating of super-fine PX gamma ferric oxide particles with an extra smooth mirror-finish surface.

All of this adds up to high output, low noise, distortion free performance and a dynamic range equaling that of open reel tapes.

3

THE SHELL — Even the best tape can get mangled in a poorly constructed shell. That's why Maxell protects its tape with a precisely constructed shell, made of lasting heavy-duty plastic.

No fixed guide posts are used. Instead Maxell uses nylon rollers on stainless steel pins thus eliminating the major cause of skipping, jumping and unwinding.

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Maxell doesn't use a welded seal, but puts the cassette together with precision screws. Result — Maxell doesn't jam.

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UD

4

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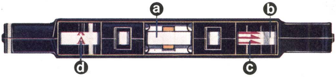

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